

Notes to Chapter 1

1. On the concept, character and history of the avant garde see Shapiro 1976, Hughes 1980, Poggioli 1982, Haskell 1983, Anderson 1984, Burger 1984, Williams 1988, Frascina ed. 1985, Laing 1978. On the musical avant garde see Griffiths 1978, 1979, 1981, Whittall 1988, Smith Brindle 1987, Middleton 1978, Rosen 1976, Neighbour et al 1983, Nyman 1974, Schorske 1961. I discuss these issues at greater length in Ch.9.

2. On this process see Hughes 1980, Frascina ed. 1985, Guilbaut 1983, Williams 1988. On music see Griffiths 1978, 1979, 1981, 1986, Nyman 1974, Manning 1985, Kerman 1985. Chs. 2 and 9 analyse, at different levels, the process of establishment of the musical avant garde after World War Two.

3. On the modern art market see Myers 1983, Hughes 1984; on modernist and avant garde influences on popular culture and commercial art see Walker 1987, Frith and Horne 1987.

4. On the analytical concept of a cultural or intellectual field see Bourdieu 1971a and 1971b.

5. This principle of analysis is advanced for cultural analysis by Bourdieu (1968, 1971a, 1979, 1981), by Williams (1981), and by literary theorists such as Macherey (1978). It is also in line with recent work on modernism and post modernism, which pays attention to the different attitudes of the two cultural traditions to popular and commercial culture. See, for example, Huyssen 1976, Crow 1983, Foster (ed.) 1985. I return to the latter issue below and in Ch.9.

6. In referring to discourse in the thesis, I am drawing on Foucault's theory of discursive formations in which, by historical analysis, he traces the close interrelations between power and dominant cultural systems or systems of knowledge as they become embodied in institutions, technologies and practices. See Foucault 1972, 1977, 1980. Foucault highlights both the power of dominant cultural systems to construct institutions and practices; and the autonomous momentum of such long term cultural systems and of their institutional expression to reproduce themselves. Wolff (1983:91) points out that Foucault did not himself produce an analysis of aesthetics and art history in terms of discursive formations, yet she sees it as a promising project. The thesis attempts, in Chapter 9, a summary form of such analysis in relation to dominant traditions in 20th century music history, and takes up the theoretical implications of this analysis in the Conclusions. Using the thesis material I address an issue raised by Foucault's analyses which he himself does not develop: whether discourse - (here that of musical modernism) - reproduces itself, or whether and how discursive transformation and change can occur.

7. This was remarked upon by Hannerz (1986) in his reply to a major review of the current state of anthropology by Ortner (1984). His call for anthropology to address the analysis of complex society,

including its specialised intellectual and cultural forms, of which he particularly mentions modern media, is notable for its rarity.

8. One very recent exception is the growth of museum studies, which is however more concerned with reproduction and canonisation than with the production of new art and culture. See, for example, Lumley (ed.) 1988, Bennett 1988.

9. Exceptions to this are the studies of media professionals, their institutions and practices, found in media studies (eg Schlesinger 1978, Glasgow University Media Group 1976, Kumar 1977).

10. Exceptions include the sociological work of Faulkner (1971, 1973a, 1973b) on professional film studio and orchestral musicians respectively; Kingsbury's (1988) ethnographic study of an American music conservatory; Hennion et al's study of French music conservatories (1983), and Hennion's ethnography of teaching music by *solfege* (1988); and Menger's report on the state subsidy of contemporary music in Europe (1980), and his sociological account of the dilemma of contemporary French serious composers and their relations with the state (1983).

It is necessary to clarify briefly the use of the terms 'serious', 'classical', 'contemporary', 'modern' and 'avant garde' in relation to music. I am following the usage within the professional world of high music culture, where they are used both descriptively and evaluatively as part of a basic classification between different musics. 'Serious' and 'classical' usually refer generically and interchangeably to the whole historical body of high cultural 'art' musics, of church, court and concert, dating from at least the Baroque period, if not from the Renaissance, to the present. These musics are defined by implicit contrast to musical 'low' culture - folk, popular, and mass commercial musics. See Durant (1984) for a deconstruction of 'classical' music.

'Contemporary' and 'modern' music are more chronological terms. 'Contemporary' music usually has the exclusive meaning of contemporary serious, or art, music, rather than contemporary musics writ large, including for example jazz and pop musics. Also, rather than music of the present day, 'contemporary' music often refers to the post World War Two period, from the 1950's on. Whereas 'modern' music usually refers to the longer period of serious music dating from the crisis of tonality at the end of late romanticism, ie from the late 19th century. This is known as the modernist period which, as I have mentioned, coincides with the rise of the notion of an artistic 'avant garde'. Thus, in fact, the terms 'contemporary', 'modern', 'modernist' and 'avant garde' music are often used synonymously. I use these terms both as 'emic' concepts drawn from the discourse of high music culture and of my informants, but also to delineate, and to periodise, distinct musical cultures.

11. One major text-centred approach to the social study of music, which might be called the critical semiotics of music, involves the analysis of music, or music-and-lyric, as encoding the dominant social order (Weber 1958, Shepherd et al 1977), or as conveying ideological messages (Tagg 1979, 1982, Bradby and Torode 1984).

12. Wolff's (1981, 1983) recent surveys of the sociology of art and

culture describe this tendency well and provide a good indication of current criticisms. She notes overall the preponderance of studies of art- or culture-as-ideology, with the rise from the 1970's of Marxist criticism within art history (T.J.Clark, J.Berger), literary studies (R.Williams, T.Eagleton, T.Lovell, P.Macherey) and media studies (S.Hall, Glasgow Media Group). All of these approaches focus on the reading of cultural texts - from paintings, books, to newspapers, television programmes - sometimes in socio-political and historical context, and aim to draw out their ideological character, their explicit and implicit social and political messages. These developments relate to longer traditions within Marxist cultural criticism, especially the influence of Lukacs's formalist studies of the novel. The thrust of Wolff's argument is for increased attention to be given to investigating the processes of cultural production, in order to demystify reified notions of creativity and of the absolute autonomy of art, and to throw light on the ways in which meaning is actually produced and materialised in cultural practices and institutions; yet she does not herself provide this kind of empirical research.

13. The text-centred critical semiotics of music either remains very ideal typical (Weber, Shepherd) or, interestingly, uncovers contradictions between various levels of musical or musical-and-lyrical meaning. This suggests that the operation of meaning as a whole, and of ideology, cannot be ascribed in a simple way to the musical sound or system. Sometimes it works precisely through contradictions, tensions, between different levels of meaning, one undermining the other; for example an implicit association subtly subverting or reinforcing an overt meaning (see Tagg 1982, Bradby and Torode 1984). This makes the analysis of meaning and ideology more problematic, and it also suggests the need for a more complex analysis of musical meaning as conveyed through the ensemble of mediations surrounding musical sound. These formalist approaches centred on music- or music-and-lyric text alone, then, risk ignoring the meanings embodied in the social practices and relations, and other cultural dimensions, that equally constitute the experience of music.

14. For example, Kerman (1985) calls for musicology to become a humanistic, holistic and interpretative discipline that interrogates music in its broader social and cultural frame. Other musicologists have called for an alliance specifically with cultural anthropology: for example Tomlinson (1984), who draws upon Geertz, and Treitler (1984), who cites Sahlins' cultural historical analyses as possible models for a culturalist approach to music history.

15. Laing's study looks at punk both as a subculture, and as a sector of independent cultural production within the music industry. So he brings into the analysis the organisational forms and production practices of punk musicians, analysing them both as socio-economic strategy, ie an independent sector involved in records, tapes, fanzines, retail outlets, clubs; but also as stylised symbolic interventions in, and rejections of, the practices of the mainstream rock industry. Thus punk's experiments in collective, co-operative and anarchic (non) organisation were comments on the entrepreneurial, hierarchical and profit directed rock business. Laing traces every level of meaning - the naming and philosophies of the bands, fanzines and record companies, performance

styles (vocal, physical, instrumental), audience rituals, variations of the punk look - and the shock tactics, inversions and confusions that were the movement's main intent. From all this, it becomes clear that the meaning of punk can only be grasped by analysing the simultaneous juxtaposition of the many levels and factors in the bricolage; and by exploring how these levels of symbolism work either in tandem, cumulatively, or more often in punk, against each other in stylised contradiction. Thus the meaning of punk music cannot be adequately grasped except by tracing its embeddedness in a total field, a bricolage of practices, beliefs and objects.

16. Methodologically, Feld proposes "six broad areas of inquiry into music as a total social fact" (1982:386). The six areas can be sketched as follows. First, competence: who can make music, and who interpret it? Are there stratifications of skill and knowledge? Are there ideologies of talent? Second, form: what are the material musical means, and how are they organised into codes? What are the preferred aesthetic forms? Third, performance: are these structured by cooperative or competitive social relations? What is the relationship between makers and materials? Fourth, environment: what resources does the environment provide, and how are they exploited? What myths and models affect how people perceive the environment, and are these related to conceptions of person or expressivity? Fifth, theory: what are the sources of authority and wisdom about music? Is musical knowledge public, esoteric, or ritualised? What dimensions of musical knowledge are verbalised? Is theory necessary? How detached can theory be from practice? How is music rationalised? Sixth, value and equality: who evaluates music? How are expressive resources distributed, are they stratified, and are imbalances manifest in ideology? Do music and sounds mystify, and whom, and why? Are sounds powerful?

17. A critical ethnography allows one to explore disjunctures arising within the multitextual whole, in a similar way to Tagg (1982), Laing (1985) and Roseman (1984): that is, discerning contradictions between different levels of mediation and meaning in the culture around music. Ethnography has always provided rich opportunities for tracing tensions and breaks between, most obviously, words and actions, ideology and practice, as shown for example in Turner's (1967:125) emphasis, in his analysis of ritual symbolism, on distinguishing between exegetical and operational meaning. In the work of Tagg and Roseman the contradictions uncovered provide clues to the operation of ideology, but also to points of social and discursive struggle.

18. Feld (1984) and Roseman (1984) stress the importance of metaphors around music, that are taken as real. Roseman argues that studying music as culture involves "primarily the cultural logics informing those (sound) structures... We need to elicit and compare the symbolic classifications and metaphors whereby the terms of one domain are layered with meanings drawn from another domain" (Roseman 1984:411). She explains that "indigenous musical theories are often articulated using terms drawn from 'extra-musical' domains.. The resultant perception of the likeness in unlike terms constitutes metaphor" (ibid: 438). Both Feld and Roseman point to the omnipresence and centrality of what I will call realms of discourse around music. Unlike metaphor, which implies a set of singular mappings of likeness, discourse suggests that metaphors

form into constellations of perceived likeness, systematic fields: that is, domains of 'knowledge' or theory. As Roseman implies, these are used both to express the experience of musical sound and, more importantly, to construct that experience through informing composition. The concept of discourse again raises issues of power - of definition, classification, of the sustenance of a belief system and exclusion of alternatives; and of ideology - that metaphors may be systematically motivated, distorted, yet naturalised or organised into a pseudo-coherence for purposes of irrefutability. These authors also raise the arbitrariness of these metaphors/discourses around music: as Barthes (1973) proposes, the arbitrary, mythical and potentially ideological relationship between signifier (music) and signified (discourse, metaphors) in what he calls the second, connotative order of signification.

19. This can be clarified by showing the misunderstanding in Wolff's (1987:11) discussion of music as an abstract form. Wolff argues that this is not unique to music, because abstract painting is also non-representational. In this she mistakes a phenomenological core (music's immanent abstraction) for a formal or discursive strategy (abstract painting as a conscious stylistic negation of realism).

20. This is Tagg's (1979, 1982) justification for initially using music as a metalanguage for itself.

21. This quality can also be seen in the work by early sociologists such as Dilthey, Simmel, Weber and Schutz on music. All treat it as an exemplar of their particular theoretical orientation: thus for Weber, the evolution of musical systems exemplifies increasing rationalisation, and so on.

22. For a well-known contemporary example of a theory of music as akin to a language of the emotions, see Cooke 1959. On the many historical recurrences, from Pythagoras to Rameau and onward, of theories of music in relation to mathematics, astronomy and science, see Weiss and Taruskin 1984. It is not my purpose here to justify my scepticism towards, for example, theories of the mathematical foundations of music or harmony. However, for an eloquent critique of the mathematical tendency (directed, incidentally, at serialism, the main technique of musical modernism) see Bloch 1985:183-194 (discussed also by Norris 1988). On the other hand, it is not necessary to reject these theories in order to analyse their universalising and 'naturalised' character, their attempt to construct bases for music that transcend any particular historical aesthetic, cultural and compositional form. As we will see, IRCAM's particular form of discourse about music - varieties of science - tends constantly towards the transcendent and universalising.

23. A few words on the attitude of the thesis towards the question of 'the music itself'. Given the musicological criticism that socio-cultural studies fail often to address the music (eg Kerman 1985), it would seem wrongheaded to neglect IRCAM music as music, or reduce it to a reflection of the social. But despite this ideal, there are problems in attempting to analyse IRCAM music. First, it is extremely complex, arguably among the most complex music ever produced, not least because - in addition to very complicated scores - it exists in computer disk and

tape form, unnotated, and therefore liable to the severe problems of analysis of all non-notated musics. Indeed Boulez's own music, some of the best known contemporary music, is not extensively analysed. It would therefore be pragmatically difficult, and naive, to attempt musical analysis in this thesis. However this situation can to some extent be remedied. I argued above that all musics are surrounded by forms of discourse, knowledge, theory, and many are subject to prior and post hoc theoretical exegesis. Different musics have different degrees of theorisation; popular music, for example, has little explicit musical theory. The thesis argues that the tradition of musical modernism - to which IRCAM is related - has a particularly intense relation with theory, so that various forms of theory are constantly drawn upon to prescribe and construct compositional practice. Indeed few musics can be said to have this degree of prior theoretical determination and prescription; so that characterising the forms of determinist theory underlying IRCAM composition may to some extent compensate for a lack of adequate musical analysis. Finally, in the later part of the thesis I distinguish between modernism and post modernism, and this involves some broad discussion of aesthetic differences between musics historically and at IRCAM. This does not involve thorough music analysis, but basic aesthetic distinctions, some of them observed and some reported. I provide some aural taped examples of IRCAM musics. This is as far as the thesis goes in addressing the 'music as music'. However, one of the theoretical themes in that later part of the thesis is of the social construction of aesthetics at IRCAM, so that apologies for failing to treat the aesthetic as autonomous are perhaps, in any case, inappropriate.

24. Bourdieu brings out the competitive-cum-complementary relation of the two sectors by noting ironically that "avant garde publishers and the producers of best-sellers both agree that they would inevitably come to grief if they took it into their heads to publish works objectively assigned to the opposite pole" (1980:280).

25. In this quote Bourdieu implies that the avant garde cultural strategy is simply a different form of economic calculation, so that long term cultural investment may eventually reap even greater rewards than mundane short term calculation. However, in the majority of his oeuvre he implies, by contrast, and as suggested in the previous quote, that economic and cultural capital are incommensurable and antagonistic spheres, for example embodied in the very different lifestyles of the two fractions of the dominant class. Certainly, he depicts avant garde ideology as disdaining material luxury and abjuring economic interest. Overall, then, Bourdieu appears unclear as to whether cultural capital is 'really' convertible into the economic or not.

26. Williams' (1981) discussion of privileged cultural institutions, possibly influenced by Bourdieu, centres on their operating a longer term cycle than the short term operations of cultural commerce, and intending thereby to slowly build up authority. He adds that "the privileged institutions.. can be seen as indispensable instruments for the production of the ideas and practices of an authoritative order, and often have to be seen as such even when, as an internal condition of their long term authority, they include minority elements of dissent or opposition" (1981:225). We see here Williams' notion of a necessary

relation between authority and a show of containing opposition and dissent.

27. Bourdieu's depiction here of two kinds of opposition or difference structuring the cultural field (internal to a field, and between it and external orders) is equivalent to Laclau's (1980) elucidation, after Kant, of the two classical forms of antagonism, which Laclau then defines as the fundamental structures of discourse. These are 'A / not A', a relationship of contradiction and opposition between two mutually defined, antithetical and complementary positions; and 'A / B', one of absolute difference, non relation, with no mutual reference. This abstract formulation of the structures of discourse becomes useful later in analysing both IRCAM culture, and the discursive history of musical modernism.

28. To clarify, almost all studies of the avant garde are also addressing the analysis of artistic modernism and/or post modernism, so that most studies use these terms synonymously. This is because, as mentioned earlier, the start of the modernist era and the rise of the concept of the artistic avant garde were almost coincident, and modernist artists came to epitomise the concerns of the avant garde, as analysed for example by Haskell (1983). However, we will see that a few writers - notably Burger (1984) and Huyssen (1986) - distinguish between modernism and the avant garde, reserving the latter term for specific uses.

29. See for example Hughes 1980, Griffiths 1978, 1981, Mellers 1962, Neighbour et al 1983.

30. Examples are Poggioli 1982, Calinescu , Haskell 1983, Nyman 1974.

31. Examples are T.Shapiro 1976, Anderson 1984, Guilbaut 1983, Shapiros 1985, Gay 1968, Willett 1978, Timms and Collier 1988.

32. Examples are Jameson (ed.) 1977, Greenberg 1961, Clarke 1985, Clarke and Greenberg in Buchloh 1983, Burger 1984, Habermas 1981, 1985, Lyotard 1984; and for music, Adorno 1984, 1973, Boulez 1971, 1977, 1981.

33. See for example Poggioli 1982, Haskell 1983, T.Shapiro 1976, Williams 1988.

34. See for example Guilbaut 1983, Hughes 1980, Shapiros 1985.

35. See for example Clarke 1983, 1985, Foster 1985, and Owens 1985 on feminist post modernism.

36. See Huyssen 1986, Crow 1983, Attali 1985, Durant 1984.

37. Huyssen (1986) summarises his position thus: "Ever since the mid 19th century, the culture of modernity has been characterised by a volatile relationship between high art and mass culture.. Modernism constituted itself through a conscious strategy of exclusion, an anxiety of contamination by its other: an increasingly engulfing mass culture... There has been a plethora of strategic moves..to destabilise the high/low opposition from within.. (But) the opposition between modernism

and mass culture has remained amazingly resilient over the decades" (1986:vii). Huyssen then, like Burger (1984), makes a distinction between modernism and the avant garde, suggesting that while modernism was founded on this hostility to mass culture, the 'truly' avant garde movements (and he cites the same ones as Burger) tried to transcend it and effect a new relationship with mass culture.

38. In a well-known and influential essay on post modernism by Jameson, which is generally quite pessimistic, one of the more optimistic passages hinges on a reference to "the synthesis of classical and 'popular' styles found in composers like Phil Glass and Terry Riley, and also in punk and new wave rock" (1984a:54). In this Jameson asserts that in musical post modernism, modernism and the popular are finally reconciled. Another common position (eg Ulmer 1985) is to cite John Cage, musical forefather to composers such as Glass and Riley, as exemplifying the post modern synthesis through his reference to non-western musics and cosmologies. I return to these issues in Ch.9.

Notes to Chapter 2

1. Rogers, who won the contracts for both the CGP and IRCAM as a result of prestigious international architectural competitions, is known as a 'neo-modernist'. He holds to a new functionalism, inspired by science and technology, in which the building's structure is revealed to the observer - as with the exterior of the CGP. (Ref: 'Architecture at the Crossroads': BBC2 TV, 19.1.86).

2. A director who had been at IRCAM from the early days depicted IRCAM's early privileged existence as closely linked to the status of the original Administrator BD, whom he described as socially exalted. "He's a very upper class *fonctionnaire*, I mean really high class.. Conseil d'Etat and all that... Boulez wanted him because he'd done all the statutes, all the paperwork, for the big Opera scheme.. they were going to take over the Opera. That's how he knew BD... (BD) was the Secretary General of a big company run by Claude Cheysson, who's now Foreign Minister". Talking of the way IRCAM and the EIC had been set up with the direct patronage of figures at the highest levels of state, the director joked ironically, contrasting French politics with those of the British Arts Council as follows: "Well, they were with us from the start! If you're not friendly with Louis the Fourteenth, then you won't be able to sing at Court! France is a monarchy, you see; whereas the British behave in a Republican-Democratic fashion! (laughs)".

3. As mentioned in the last chapter, I was not given access to Artistic Committee meetings; but I was shown some minutes of the meetings from 1983-84 by friendly informants who had received them.

4. IRCAM's share of the CGP resources can be gauged by figures from 1981. In that year, IRCAM's budget of 18.89 million francs was just under 10% of the CGP's total budget, while IRCAM had 54 posts (c.5%) of the total of c.1000 employed by the CGP as a whole. This demonstrates, again, IRCAM's privileged status vis a vis the CGP, since the institute receives a share of the Centre's global funds equal to twice that equivalent to its employment base. This is justified by reference to

IRCAM's technological infrastructure, its production and research needs.

5. In theory, concerts that are in large halls and well attended can make money. However, the IRCAM hall holds between 220 and 360 people; and in 1983, for example, audience attendance varied between a low of 11% and a high of 97% with a mean of only about 55%. Audience figures are clearly not high. Menger (1980:51-2) analyses the factors involved in the best attended concerts given by the IRCAM orchestra, the EIC, not at IRCAM but in major venues. He finds that high audience figures correlate most strongly with the fame and prestige of the conductor, so that Boulez and Abbado draw full houses. He finds generally that they correlate also with the status of the concert hall. Boulez conducts only occasionally for IRCAM related events, and more often with the EIC. Whenever he conducts, his concerts attract large houses. Audience figures for IRCAM performance events sometimes follow the law of rising sharply for well known figures, including composers and the EIC itself which clearly has a following. Thus concerts by Cage in January '81 drew full houses; however, by contrast, a concert series in December '83 by Stockhausen - just as big an avant garde star - drew an average audience at IRCAM of only 58%. IRCAM's prestigious concerts and tours abroad may also appear to be potential earners; yet they are extremely expensive and so generally lose money and require substantial sponsorship. For example, the 1985 'Repons' tour in the USA, which took in 5 cities and 14 concerts, cost around US \$560,000 (c.US \$40,000 per concert), which was totally subsidised by the cities concerned and by corporate sponsorship, including the computer giant IBM among others.

6. Boulez has the run of the highest levels of the contemporary music world; while WV is himself a contemporary music impresario who started a major contemporary music orchestra, and was previously manager and agent of Berio and several other luminous European composers. WV therefore has strong contacts on the European music scene, with other impresarios, agents, managers and publishers - the key mediators - as well as musicians.

7. HY, an instrumentalist and an ambitious young composer, studied at the Juilliard School, the prime East Coast conservatory; and later with Elliot Carter, one of the senior figures of American composition, who is also a friend. He returns regularly to the US for concerts and research visits, and after 1984 gained a job at a prestigious East Coast college.

8. In 1984 the posts break down as follows. In the scientific sector there are 13 posts: 10 in 4X projects, 1 in Chant/Formes, 1 in Acoustics, and 1 for the Scientific Director. On the musical side, there are 8 posts: 1 for each of the 4 music department directors, and 1 for each of the 4 tutors. Of these, 5 are musicians and only 4 are actually composers (plus Boulez), and none are employed primarily as such. Four technical / service teams - Systems, Sound, Mechanics, Esp Pro - have between them 10 posts. There are 10 posts for the Administration, and 12 clerical posts. Finally, there are 2 more directors: Boulez, and MA, in charge of the Production Office.

9. Thus a worker on a one year vacation contract in 1984 had legally to take four months' unemployment leave before a new vacation contract could be issued.

10. Illustration 2.4 is a copy of a memo from the Artistic Director giving the names and fees of commissioned composers due to come in 1985-86. It shows the close range, between a bottom fee of 20,000 francs for young unknowns, up to 30,000 francs for the well-known composer Ferneyhough and 35,000 francs for the leading Italian composer Busotti. Given that this may represent more than three to six months' work, payment is not high, although living expenses are additional. However, I was told confidentially that in practice certain 'stars' are paid over this range, since their higher value is set by their kudos in the international market of contemporary music. Certainly, differences of treatment were apparent for the visit of Stockhausen, probably the biggest international 'star' after Boulez himself. In advance of his arrival, secretaries were issued with extraordinary, mythic instructions for his hotel accomodation: to find a bed big enough for three, and a bedroom with an antechamber just off it in which Stockhausen could retire to compose. Other composers are simply given a list of recommended hotels and CGP flats. Composers' asymmetrical treatment derives from the objective conditions of the field: that young less known composers need their visit to IRCAM to add prestige to their career, while IRCAM needs the patronage of internationally well known and prestigious composers to affirm its status.

11. In 1984, two *stageaires* attached to the Chant/Formes group were used to provide useful research labour; while two attached to Pedagogy remained at a loose end for some months, while they tried to think up their own projects.

12. These self-constituted subcultural groups can be contrasted with the categories of workers who might be expected to identify themselves as a group, but do not. For example, the badly paid junior tutors have close friendships and many belong to the musicians group, yet they remain fragmented and seek no collective identity. Similarly, the badly paid women clerical staff, who unlike junior tutors belong to a recognised staff category, have friendships but are fragmented. We see in the next two chapters how these examples of an absence of collective identification relate to the very different conditions and interests of these two groups of workers. Finally, the short staying groups of squatters, composers and visiting researchers do not form collective identities, except where they derive from common external identification, which they often do - for example as computer musicians or composers, or as American computer programmers circulating within a network of institutions.

13. The distribution of nationalities was as follows in 1984. IRCAM's permanent staff are overwhelmingly French: 48 out of 54. The six remaining are all senior staff, with three to four American directors (one is half-French), one Italian, and one the British Artistic Director. It is at the level of temporary staff and regular visitors that a greater diversity of nationalities comes into play, but again with marked bias towards French and Americans. Of the 44 regular temporary workers, 25 are French, 10 American, and the other 9 include one each of the following: an Anglo-Argentinian, an Australian, an Italian, a Finn, a German, a Dutchman, a Hungarian, a Rumanian, and a Russian. It is notable that of visiting consultant computer scientists,

all except one Australian were American in '84; while of temporary, low paid staff and squatters, including junior tutors, one was American, four were French, but the majority were from an ad hoc group of young foreign workers (the Italian, Dutchman, Finn, Rumanian, Hungarian and Russian mentioned above). One junior foreign worker was experiencing work permit problems, which made him especially vulnerable to bureaucratic control; while the East Europeans were vulnerable due to their strong desire to avoid returning to the East.

14. For example Ill.2.4, the list of twelve proposed commissioned composers for '85-6, shows careful attention to the range of nationalities: (there are four British composers, two French, two Italian, and one each from East and West Germany, Spain and Japan). Other preparatory lists for commissions and stages show similar attempted coverage, and regularly include at least one composer from Britain, Italy and Germany. American composers are notably absent from these lists, as are British composers favoured. The lists are constructed by the Artistic Director, who mainly looked after the European composers' circuit and left the Americans, about whom he thought less well, to his American colleagues.

15. From IRCAM's account, up until 1987 there were 36 completed French commissions to 24 American, 10 German, 10 British, 7 Italian, and 6 Finnish.

16. The re-organisation was covered, following a press release in May 1980, by articles in most French quality papers (eg Le Monde 'Les Nouvelles orientations de l'IRCAM', Le Nouvel Observateur 'Le tournant de l'IRCAM', Le Figaro 'IRCAM: Boulez seul maître à bord', and in Le Monde de La Musique and l'Express). As we see below (Ch.2.3.2), harsh criticisms of Boulez's 'regime' at IRCAM came from rival French composers Xenakis and Eloy.

17. Boulez suddenly, out of the blue, called a rare *Reunion Pleniaire* (general meeting) in which he announced the new structure and allocated positions within it. Even those suddenly promoted were not warned of the 'coup' and were taken by surprise at their advancement.

18. Much high level American computer research, including the field of artificial intelligence (A.I.), originates in Pentagon funded defence projects. A 1983 Newsweek article explains: "The Pentagon's Defense Advanced Research Projects Agency (DARPA) is, more than any other single agency in the world, responsible for the shape of advanced computer science today... Over the past 20 years, DARPA has poured half a billion dollars into computer research, in the process virtually creating the science of artificial intelligence" (W.D.Marbach et al, Newsweek July 4, 1983). It is estimated that some 55% of basic and 87% of applied American computer science research in 1983 was funded by the Defense Department (Athanasίου 1985:31). American computer music, with some of its roots in A.I., thus links with areas of research funded by the military.

19. Mathews' pioneering computer music teaching text is called The Technology of Computer Music. His seniority in the telecommunications research world is signalled by the fact that he was the man who was

given the task of decoding the Watergate tapes.

20. Yamaha, one of the largest music technology multinationals, have since made Chowning's digital FM technique the basis of all their small commercial digital synthesisers. Chowning and the CCRMA were extremely glad of the freedom granted by the substantial FM royalties. For political reasons, Chowning had earlier divorced CCRMA from its parent, SAIL, since his group objected to SAIL's heavy defence funding; so that until the Yamaha deal, for a period the computer music studio had been poorly funded. This shows how commercial links can sometimes be used in the academic community to achieve autonomy from compromised industrial links, such as defence applications.

21. An apocryphal story is told by IRCAM Americans of the earliest computing days at IRCAM, illustrating what is seen as the inept and unprofessional attitude taken by the French bureaucracy, and a clash of cultures. An American consultant systems programmer, BH, was brought over early in '76 to work on the main computer, the PDP10, and get it going. When BH arrived at IRCAM, he found that the institute operated only during the normal office day, rather than a full twenty-four hours as do all self-respecting American computer centres. He also found the PDP10's memory size limited - an economy of Mathews', known as a frugal man. The story goes that BD, the French IRCAM Administrator, noticed BH sitting around reading sci-fi magazines all day long and asked finally "What are you doing? Why aren't you working?". BH replied: "I don't have anything to work with!" He demanded more memory for the machine, and twenty-four hour opening, until which time he would sit in his hotel room reading comics. After many battles with the Administration, BH won and IRCAM invested in more computing power and round-the-clock hours.

22. By 1977, Berio had brought in the Italian physicist BU to design a prototype realtime digital synthesiser for him, which later became the 4X. BU had originally been inspired in the task by a visit to Bell Labs where he met senior Bell engineer Hal Alles, renowned world wide for his work in digital processing and designer of some major electronic music technologies. In '77, Alles came to IRCAM and helped BU to design and construct the first prototype of the 4B system. By 1980, BU's IRCAM team were still relying on Stanford help, from researcher CA, to write the first higher-level, musically oriented command language for their next prototype, the 4C (Manning 1985:253).

23. In '78 Mathews and WLe wrote a paper in which they in effect strongly advised against the pursuit of the 4X project, ie building a realtime digital synthesiser. They argued that "Because at least one extremely convincing design for a very general and powerful digital synthesiser exists already, it is not clear how necessary it is that we [IRCAM] invest great amounts of time in this project. On the other hand, no very suitable or compelling device exists to render synthesisers musically useful" (Mathews et al 1978:1). They proposed instead that IRCAM should concentrate in the area of hardware on developing realtime control devices for all-purpose synthesisers: that is, on the unaddressed problem of gestural control and of physically, conceptually and musically appropriate control devices for the new generations of digital sound producers.

24. We will see in Ch.9 that it is typical of one dimension of the American computer music scene that, alongside his high powered executive role, Mathews cultivates a simpler artisanal involvement in music technology. Thus, in the early days at IRCAM he was known for some time to be obsessed with designing and making by hand an electronic fretted violin that could interface to a computer. Eventually, he built such an instrument (and also made one for the performance artist and pop star Laurie Anderson). There is an early IRCAM story of Mathews, bursting with excitement, rushing to tell Boulez that he had just succeeded in finding the key to the design problem of the fretted violin. Instead of sharing Mathews' pleasure, the story goes that Boulez greeted the news with a certain ill-disguised 'sang-froid' bordering on distaste. This was not Boulez's vision of inspired computer music applications.

25. The Lucas Film ASP is a realtime digital sound processor capable of synthesising, producing, editing and mixing together a complete film sound track. As well as being used in-house to produce the soundtrack of, for example, the movie 'Indiana Jones and the Temple of Doom', the ASP was commercially industrialised, and some were sold to the film industry.

26. Exchanges between IRCAM and Lucas Film remain common. For example, the two consultant systems programmers (NM, NRD) brought in to IRCAM to accomplish the major changeover in operating system in '84 were both consultants who had worked at Lucas Film (now freelance for IBM and others). Computer personnel exchanges in fact link together all the key institutions mentioned into a large network within which researchers whose skills are in demand can roam. For example, the young IRCAM Systems team director FA, when he left IRCAM in '84, went to work first at Bell Labs, and moved on after a year to Lucas Film.

27. Schaeffer's main theoretical treatise is Traite des Objets Musicaux (1966).

28. The officials put their thoughts on the loss of aesthetic individuality at IRCAM thus: "It's a bit dangerous that it's not an individual using the things to make music (at IRCAM), but an institution... One loses naivety in this machine. At IRCAM, as in movements like Surrealism with a theory, manifesto, the different personalities are lost,..by manipulation into a theoretical position: there's something else than music at IRCAM!" (JPO/HG int, my transl.).

29. The officials described Boulez's successful patronage and loyalty thus: "Boulez is someone who's very interested in youth: there have been some disasters but..there have also been some good discoveries (of composers) - for example Manoury, Benjamin... Boulez holds strongly to 'his institute'... He's been made several other propositions: to direct the Paris Opera, the Paris Orchestra. He..refuses to take responsibility.. He resists and stays with IRCAM: because he believes in his symbol of IRCAM, he sees IRCAM as the most important, a research centre, a vanguard" (JPO/HG int, my transl.).

30. The compositional technique known as serialism (sometimes called twelve-note or dodecaphonic composition) was developed in the early 1920's by Schoenberg and his pupils Berg and Webern, known collectively

as the Second Viennese School. Serialism and its descendants are usually considered the dominant aesthetic of the modernist tradition in music. I discuss these developments further in Ch.9.

31. The book is Boulez's Penser la Musique Aujourd'hui (1963).

32. For example Heyworth, in his biographical essays on Boulez, reports the following analogies. Messiaen has said of Boulez: "He has surpassed us all. For me, Pierre Boulez is the greatest musician of his generation, perhaps of this half-century. I must say that he is a genius" (1973a:45). Virgil Thompson, veteran American composer, "... saluted (Boulez) as 'Europe's finest composing ear and brain'" (ibid:45). Otto Klemperer, considered the greatest living conductor before his death, "hailed him as the outstanding conductor of his generation" (ibid:45). And finally Stravinsky, held to be one of the two masters of the first half of the century, and despite Boulez's attacks on him as a student, "hailed Boulez as the founder of a new school of French music and as 'far and away the most intelligent conductor in orbit today'" (ibid: 45). Stravinsky and Boulez became close in the late 50's, the old man acting as Boulez's patron in the musical community. Yet we also see here the opposite process, since by the end of Stravinsky's life the two had fallen out badly. According to Heyworth, Stravinsky then accused Boulez, in print, of being an 'arch-careerist', and called Boulez's piece 'Pli selon Pli' "pretty monotonous and monotonously pretty" (Heyworth 1986:23).

Notes to Chapter 3

1. I show later that within IRCAM's research and production sphere, a higher level opposition is made between 'production' and 'research', giving 'production' a more restricted meaning - that is, intellectual and originating labour that results in a specific musical or technological output or product - as opposed to 'research', seen as open-ended intellectual labour that is not tied to, and may not result in, specific products.

2. Significantly, NF is marginalised in Artistic Committee meetings, in which, although a legitimate member, she is not considered to have authority to speak on musical, artistic and so on the highest level policy matters. She is, of course, the only woman on the Committee.

3. The main attempt to change women clerics' access to the computing environment was instigated by the new Scientific Director, who ordered them to learn word processing and use the terminals in an effort to 'modernise' them and increase efficiency. Secretaries told me that they resisted and that the attempt foundered since not only was it impracticable - there were never enough terminals free during the office day - but it became clear that word processing was inefficient for letters and daily paperwork. Secretaries thus defend their distinct domain against its redefinition from above [OR int].

4. One hacker could regularly be glimpsed working into the night in his darkened room, until he fell asleep slumped over his terminal, sometimes with a half-eaten baguette in his hand dripping crumbs into the machine.

5. The Esp Pro team run a small professional theatre group outside IRCAM, and take plays on tour around France. The Sound director is himself a composer outside IRCAM, and the team do professional recordings for musicians: they are encouraged to hire out the IRCAM recording facilities for commercial fees to outside classical performers. Three of the four Systems technicians have 'secret' artistic lives: one is also a composer, one a sculptor, one a graphic designer. Of the women directors, the Diffusion director previously had a career in publishing and is from a sophisticated cultural milieu; while the Production Office director worked for the main Parisian cultural festival, the *Festival d'Automne*, before IRCAM.

6. There are some non-musical IRCAM workers who feel they have a 'natural' affinity for working at IRCAM because of a close relation to music through familial or other links. These workers cross the range of jobs and statuses: from secretaries to scientific researchers. One secretary has a brother who is a well-known French concert pianist and a specialist in contemporary music. "Contemporary music was always in the family: my brother began to play Messiaen before he played Mozart. He won the Messiaen prize at Royan..." She came to IRCAM through her brother's contacts with the Artistic Director: "My brother knew many people in the music world: he knew WV and I did too". Urbane and knowledgeable about contemporary music, she said of Boulez before coming: "Oh yes, I knew of him!.. yes, I was quite impressed!" and laughed self-deprecatingly. She organised early on to work with Berio, the leading Italian composer and ex co-director: "Ya it was fantastic! And we had some enormous people like Berio, Globokar.. I was very excited by that... I loved Luciano (Berio).. as a person, and also Italian culture and the language". [All WH int]. Another secretary came to IRCAM from being assistant to a major European orchestral management organisation, and so was motivated by the idea of working with musicians. IRCAM's main acoustician also has direct musical links, through his brother who is a violist in the EIC; while the Personnel director's father was a provincial orchestral leader. Of his less exalted musical roots he says: "Yes we always had music in the family, a musical atmosphere, since I was little. That's why I'm glad to be here at IRCAM - even though the music practiced by my father wasn't the same music that's made here..(laughs nervously). But anyway, one lives just the same with artists, the music, the artistic.. things that please me". Thus familial and background links to music for workers from all levels cut across other possible cultural divisions, and provide a strong sense of identification with IRCAM's musical mission.

7. A long staying secretary recalled these events with an ecstatic nostalgia:

"Everyone was supposed to come: it wasn't very high level. The atmosphere was so good! We all learned together, and I was so happy to discover that the music I could hear on the radio, that I didn't like, could attract me. And then I was very very motivated and I went to concerts many times... Maybe 'Passage' was a bit.. special, unprecedented. It wasn't too experimental, maybe it was made to be just a little bit attractive, like an introduction of IRCAM in Paris, in France... And this was so good for me, it was the right music at the right time for my mood at that very moment" [LK int].

8. The Administrator's critical attitude barely covers her own personal dislike. Following IRCAM music, she says, is "...about education: (and) that's annoying.. I mean, in relation to the public; it takes a certain time for them to get used to it".

Q: 'You have sympathy with the public's problems with contemporary music? '

TY: "... (laughs ironically, as though to say 'Do I!') Me - I've already spoken of this to Boulez, but! (raspberry!...).. without success. What I'd like to see in relation to the public is: that all the links are explained - between the classical school, the period at the turn of the century, the Viennese school - and then today. And what I said to Boulez, I said: rather than doing IRCAM commissions, to explain.. how the work was made, etc - rather than that to people who understand nothing!... And Boulez agreed the other day that the information given at concerts is too complicated for the public that's there, that understands nothing; and if it's a specialist public, on the other hand, it's too general - not interesting to them. So it falls between two stools!... But for me, if we talk of the general public, of which I'm a member, I'd like it very much if they'd explain to me some of the many things I don't understand - dodecaphonic music, for example, things like that. It's necessary to have a link: how today we've arrived at Stockhausen, Boulez..."

Q: 'You mean all the revolution after tonality?'

TY: "There you are! Yes, all that! And that they don't teach or explain here. So the response of Boulez was: no, we mustn't do that, because here we're an institution for creation, and so we must only show and explain creation and not the other things... At concerts, they only do IRCAM pieces! There are no links to other (educational) seminars. (Raspberry!!) It's a bit tough. That doesn't work for the public: for them, it's important to give some carrots" [my transl].

9. IRCAM's postman explained: "I don't go to concerts.. it's too expensive.. but I spend on collecting cassettes... I've listened to one record by Monsieur Boulez, but the music is difficult to register, to take in... (Of IRCAM music:) It's not that it's not for me; it's that my ears aren't used to that music! I can't explain.. it's not easy to say. I've helped with a rehearsal.. I can't remember which music, directed by Monsieur Boulez in the Esp Pro. I don't know what it was! I watched it: an enormous amount of instruments, I saw Monsieur Boulez who conducted" [my transl.].

10. A secretary expressed her tastes as follows:

" My mum liked classical music - Beethoven, Bach, Haydn. My dad liked jazz, above all gay and amusing - Sydney Bechet. I discovered Gershwin's 'Rhapsody in Blue' - ravishing! I was eight... The radio wasn't very important - just for 'variete' (French pop songs) - we liked it OK... Rock or pop? No, I'm not very 'rock/pop'. I love very much Ella Fitzgerald, Jessye Norman.. singing the blues. I don't like violence at all, I like some harmony. (I last listened to) Fabien Thibaud, a French Canadian singer - d'you know him? I think he's got a very pretty voice. Apart from that, I recently bought 'Pulcinella' by Stravinsky, and I adore that record.. conducted by Boulez! (shyly)" [QRC int., my transl.].

11. The postman explained the place of music in his life as follows:

"I have six to seven hundred cassettes: it's a collection that's not complete, it lacks some - they're arrangements, a mixture... I buy cassettes because they're less expensive, I watch for things coming on sale... I buy more cassettes than I listen to! I buy them when they're on sale, because I may not be able to find them again in a month.. That's good to do.. I can listen to them in future years, my collection... I listen to music at the week ends, because I play sports nearly every night: combat sports, like karate or judo... I feel like a cassette, so I put on a cassette.. and then I'm away, and that's it! I listen only to cassettes: I make a selection, I choose the pieces that please me and I erase the rest.. from the radio... Me? to listen to great music ['la grande musique': he means serious music] I must be in a room all alone, and only listen to that. If not - if there's noise, the telephone, the door bell - if one's disturbed, it doesn't work. The only piece of classical music I've got is the 'Sword Dance' - Khatchaturian? Rimsky Korsakoff? I can't remember.. Beyond that, only Ravel's 'Bolero'. Those are the only two - quite modern..." [my transl.].

12. In addition to FLu, two other East Europeans also had marginal positions within IRCAM during 1984. YI, a Rumanian and a composer, was working as a Systems technician; while Soviet musicologist FQ had been trying for months to gain an audience with Boulez, since he had written an analysis of Boulez's 'Le Marteau...'. FQ remained on the music research margins throughout 1984, hoping to find a way into IRCAM.

13. For example, a visiting consultant reported that he was told, inaccurately, that he was asking for pay higher than anyone else at IRCAM, including Boulez (NRD int), while a young foreign worker was also misled about his position (HM).

14. The classification is as follows. Salary categories 1 to 7 are officially known as *employes* (employees), ie workers with no responsibility over other workers; category 8 workers as *agents de maitrise* (agents of control), ie workers with communication functions between the lower and higher staff; and categories 9 and up as *cadres* (officers, leaders), ie workers who command, and have responsibility for, other workers, or whose work is considered qualitatively expert and important.

15. I estimate the pay available for the top three directors by deducting the maximum possible total of wages for all the other posts known (c.8,320,000 fr.gr.p.a.) from the year's estimated budget for permanent personnel (13,146,000 fr.gr.p.a.). This leaves c.4,826,000 francs which, divided by three to give a rough sense of what each would get (although Boulez would no doubt be paid far more than the other two) gives c.1,609,000 fr.gr.p.a. or c.134,000 fr.gr.p.m. for each top director (c.#140,000 gr.p.a. or c.#11,700 gr.p.m.).

16. This figure appears extremely high, but in fact it is close to that given by one *honoraire* American computer consultant, who received a fee of c.34,000 fr.gr.p.m. (c.100,000 fr. over 3 months) plus expenses (in the region of 10,000 fr.p.m.), plus his return flight from the USA.

17. Of the 16 salaried women, 13 come within the lowest 6 grades of pay.

The one woman technician (ARY), despite being in the the highest status technical group, is paid in category 6 - lower than most other technicians. None of the three women directors are paid in the two highest grades.

18. For example, the new American Systems manager BoW asked for the pay of his previous job at Berkeley to be equalled as a condition of taking the IRCAM job.

19. This is shown nowhere better than by the advice given to me by several IRCAM musicians that if I used my time to produce some interesting musical research it would open many doors and do wonders for my career, while simply to have made a visit was in itself prestigious for my CV.

20. The Artistic Director posed the dilemma thus:

WV: "We need composers at IRCAM, but do we need them actually running things?... They're not administrators.. so how do we find a system where the composer does more than just a research project or work, and yet is less than a permanent fixture?"

Q: 'You mean (they) should not be on a permanent job at all?'

WV: "Yes, that's right" [WV int].

It must be added that these views, which clearly exempt Boulez himself, are also an implicit dig at his colleague HY, a composer, who is director of Music Research and a major rival on the Artistic Committee.

21. Thus, the Artistic Director talked about his aptitude for finding talent as follows:

"And I spotted very quickly, which I've always spotted, very cynically, what my grandfather told me years ago: all these people who think they're creative and they aren't. And also.. it's a terrible thing, but one has to say it: this ruthlessness about the second rate... In other words, you've got to be successful or, at least, don't have illusions. If you're a crummy composer it's much better to listen to music rather than try and do it... Whereas the amateur English tradition is 'realise yourself'. And also the fashionable tradition now... everywhere, is 'everybody's an artist; everybody can speak'. If you read Monsieur Fleuret (mocking, of the Dir. of Music at the Ministry).. and this idea, which he actually announces, that everybody should make music, every discipline is equally worthy - whether it's rock, jazz, folklore .. - all '*les musiques*' as the French say, plural.. No, they're not equal, I don't agree.. I believe in fine art, I believe in aristocracy, and I believe in elite.. and all these difficult things... Yes, my job is the missionary side of the job - it sounds pretentious - not to be sadistic, but.. it's to ask for the very highest standards you possibly can. Very soon, for example, I spotted the conductors who were any good... [Later, about talent:] So how do I think I 'know'? Well, I don't know that I do know" [WV int].

22. Bourdieu himself appears unclear as to whether the marginal avant garde position, high on cultural capital but low on immediate economic reward, is based on the principle of delayed accumulation and so on a realistic expectation and calculation of greater eventual economic returns - a view he hints at in his 1981 paper, backed by a sketch of sales curves (pp.281-282); or whether this is simply the ideological

stance that justifies the self-willed asceticism of the avant garde. I think he thus leaves it unclear whether cultural and economic capital are ultimately commensurable or incommensurable spheres of power and value.

Notes to Chapter 4

1. See Ill.4.1 for an example: a memo - formal, legalistic, exhaustive - from the Administrator tightening up security procedures because of thefts, and threatening sanctions on those, including *responsables*, who are 'lax'. Ill.4.2, by contrast, is a memo from Boulez showing his equally formal but abrupt and brief style: it announces, without warning, the appointment of a new Administrator and the departure of the incumbent TY. The system of written administrative memos contrasts starkly with the constant impermanent and unrecorded computer mail communications that fuel much of the research culture and informal dealings of the house.

2. Ill.4.3 is a xerox, sent to the Systems manager by the Administration, of the latest official french translations for english computer terms. This formal creation of a french computer vocabulary betrays not only nationalism, but the newness of the field. The process occasions some hilarity amongst IRCAM computer workers - many of them American or non-French - when they read that henceforth 'bugs' are to be known as '*bogues*', 'spool' as '*spoule*', 'restart' as '*relancer*'.

3. Some three months into fieldwork, and still confused by who was what, I finally found an *organigramme* by venturing one evening when nobody was around into Boulez's office. There, on the wall over Boulez's desk, as though to remind him of bureaucratic functioning, was the diagram that many had mentioned and none had been able to find for me.

4. For example, IRCAM's video team is made up of workers from Diffusion, Esp Pro and Regie Batiment; they are self-taught and do that work unofficially as a second, informal job.

5. For example, as we have seen (Ch.2.1.5) VO acted as the main liaison with commerce in the attempt to gain an industrialisation deal for the 4X. An informant commented: "(VO) never really did any acoustics. The whole time he's been here he's done mostly budgetary management. He's done very little basic research.." [BYV int.].

6. A secretary exemplified the process of negotiation over promotion and conditions for clerical staff thus. "For example, a secretary, if she's very responsible for many things in her department; and if she doesn't think she's paid to reflect that, she's talking to her head of department, and her head to Personnel, and he to TY (the Administrator). The argument therefore would be put through someone else's mouth, not her own. Perhaps if she could talk straight to TY, she'd put her case better and stronger. By contrast, if a head of department has the same problem, he would first go to Pierre! And Pierre would say 'Hmmm, I guess so', and talk to TY. So it's two different trajectories! It's typically like that. (Another example:) XR (a secretary on a vacation) wanted holiday pay: she had to talk to DY (secretary to Personnel), who

talked to KG (Personnel director);... and after a month or so, they said yes! So she had to go through a chain of people to do that. It's bad psychologically to be behind so many closed doors: it makes you feel you have no control" [LK int].

7. The hapless demonstrator said naively "I'm sure someone must know a tune or two here!"

8. It is interesting to note that Boulez's observation was not particularly profound; I had been on the verge of perceiving the transcription mistake, and anyone with musical aural training could have done. This suggests that, in a situation with few musicians present, Boulez's skills can be experienced in an exaggerated way. It should also be mentioned that the problem of computer recognition of basic musical meter is not trivial, but a major psychoacoustical puzzle akin to that of semantics for speech recognition.

9. We have seen that IRCAM's first Administrator, BD, had been a friend of Boulez's; while the recruitment of American computer music staff had originally been through the personal networks of Risset, Mathews, Chowning and RIG at Bell, Stanford and Michigan State. Computer consultants still tend to come through the extended personal networks that stretch between IRCAM and Stanford, Bell and Lucas Film - the head of which is ex-Stanford and ex-IRCAM.

In the following we can see one of the main sources of IRCAM's musical patronage networks. The Artistic Director described his position in the period leading up to his recruitment thus: "I was with the (orchestra) for five years, I did their first tours. And then I got into the orbit of all these composers: Stockhausen, Xenakis, Berio, Birtwistle, Maxwell Davies, Taverner.. all these people. I got to know them all before I knew Boulez. The first trip we went on abroad was with Berio. I became Berio's manager... I was also Birtwistle's manager. Then I met Boulez, in 1970... Then Hartog (?), who was a friend of mine and helped me a lot when I was a little boy, was Boulez's agent. And he'd actually fixed up this.. he made the connection between Boulez and me. DA and I went to a concert one day that Boulez conducted, and Boulez said 'Ah, we're going to work again together soon..'. I thought he meant he was going to come and conduct the (orchestra) again, he'd found the time or something. Then I got a call from Hartog (?) saying 'Boulez wants to offer you a job'; I didn't know what it was all about. I went for lunch with Boulez at the Hilton; and he said 'Oh there you are, Pompidou this 'n' Pompidou that'. I said: 'Can I think about it? But I'm (sure)..'. and two days later I said 'I'd love to come'. WV brought with him his composer contacts, amongst them Berio (whose manager he had been), whom he then recruited as head of the Electro-Acoustic department.

Personal favour operates at lower levels too. One of the 1984 *stageaires*, an unruly adolescent Parisian musician called VT, was the son of an internationally known sculptor who was a friend of Boulez's. VT boasted of Boulez's having been to their house to discuss VT's talent with the troubled father.

10. Weber writes of four ideal typical forms of succession to

charismatic leadership, of which one comes close to this process: "Designation on the part of the original charismatic leader of his own successor and his recognition on the part of the followers... In this case legitimacy is acquired through the act of designation" (Weber 1968:247).

11. It is possible to see WV, the Artistic Director, as the first 'young man' brought in and given a chance to excell by Boulez. But WV is no composer and so unsuitable as heir; he was rather an up and coming impressario who brought with him a great deal of accumulated cultural capital (see Note 9 above). WV himself is well aware of the phenomenon: "HY was given a lot of power at that time (1980). Given too much power too young. Well no, that's one of Boulez's things. He did the same to me, actually, so.. God! I was a kid! I was 27 when I was brought here! And he did that to the first violin in the New York Philharmonic, and it didn't work out. But he's done it with other instrumentalists and it's worked beautifully. It's always a risk. And he's always on the side of the young, rather than the proven. I think it's a generous fault, sometimes.. it's the way he thinks". At the time of this interview WV was himself manouevring to leave IRCAM gracefully.

12. WLe's own view is that Boulez had not found him sufficiently strong as a manager and organiser which, he considered, was the real role that Boulez had in mind for him. The aesthetic and technological disagreements, he felt, compounded this.

13. The stage acts as an informal talent-spotting ground and, because of the interconnected speaker system, *stageaires'* sounds can be listened in to by others in the house. However, in order to discourage *stageaires'* ambitions, IRCAM staff disclaim that the stage has any relation whatsoever to working at IRCAM. Nonetheless, when they want to, staff do recruit from the stage.

14. However, patronage is found more broadly and continuously in the higher production sphere, not all of it linked to such high promotion. Boulez, less spectacularly, intervenes in the appointment and promotion of key scientific and high technical workers - for example the new American Systems manager BoW, as I showed earlier; and he also held open a post for the IRCAM programming 'wizard' NGF while he was away doing a PhD in Germany. We have also seen the role of MC, director of Chant/Formes, who brings in young composers and fills out his group with his scientific graduates. The Chant/Formes group as a whole, with their close relations and utopian technological ideology (discussed in later chapters), court the charisma of bohemian intellectuals. As we saw in Ch.3 the leader MC, on a half time insecure contract at IRCAM, himself exemplifies the 'intellectual ideal of negation' and 'material asceticism' by which Bourdieu characterises the vanguard intellectual. He is himself therefore a charismatic scientific leader within IRCAM.

15. It is interesting to note Boulez's views on the problem of succession which he gave at length in an interview as follows. It reveals a humorous self-awareness, playing on the analogy between himself and absolute monarchs, and so acknowledging the elements of charismatic leadership and dictatorship in his position.

Q: "Do you think about organising your successor (to direct IRCAM)?

Boulez: "Ah! So! I am not Tito, but... It's a problem that I must reflect on. But I don't believe in institutions nor in wills. Sometimes, I re-read the passage from Saint-Simon on Louis XIV's will. It's a marvellous text! From the morning after the death of the Sun King, the absolute monarch, his will - nobody gave a damn! I tell myself that if it was like that for Louis XIV, what's it going to be like with the little director of IRCAM! So, it's useless to plan a succession. The organism (IRCAM) is in place. Tomorrow, if I had a car accident, it would function for several months, perhaps a year.. Who would replace me? I don't know. It needs someone with energy, ideas, altruism, organisation and who keeps everyone in mind. You don't find that under a horse's hoof!"

Q: "IRCAM is therefore your instrument?"

Boulez: "Yes, temporarily. But at the same time, no one is indispensable. When I read the obituaries - 'What an emptiness has been left by (the death of) Mr. X or Y!' - I always think: one tree falls, 46,000 shoot up!"

[Source: Le Monde de la Musique n.24, June 1980, my transl.].

16. A secretary commented on this: "The current *Delegate* is YY (technician): no one thinks he's a good guy, so it's strange he's the *Delegate*. When you belong to the *Comite* or *Delegate* there are higher or lower roles. I was in the higher position: and if you belong to the higher positions, it's almost impossible for the employer to fire you. And YY wasn't in a good position, and people think he tried to become a *Delegate* to protect his job - he was about to have a baby.." [LK int].

17. Fear of the Administration was apparent in another secretary's reaction to my interviewing her. For the first hour, in contrast to her earlier friendliness, she was reticent, timid and barely spoke. I 'stopped' the interview and asked her what was wrong. She then revealed that she was under the impression - despite my repeated assurances to the contrary - that my research was for the Administration, implying that it could be used for checking up on her and others. This secretary had previously experienced problems in work relations with a notoriously difficult director. Her powerful fantasied projection speaks of a strong sense of persecution by management among low status workers. Hostility towards the higher Administration is therefore a broader phenomenon found amongst low status workers. It can be glimpsed, for example, in the words of yet another secretary who felt insecure and said of the Administrator, with whom she had negotiated her short contract: "TY follows the rule to the letter, she's not tender, not at all... She told me bluntly last November: 'If I were you, I'd start looking for another job'... I've heard that she can be a real bitch".

18. The secretary OR told the story as follows. "(The Administrator BD) wasn't completely odious, although he has to be on the patron's side. He was slightly embarrassed, since he'd known me since (early days). We were there two hours together.. Then I had another recorded delivery letter saying perhaps I'd like to go down to the scientific sector, where I could show that I could 'reconvert my personality' or something - 'redress my attitude'!.. BD could have done absolutely nothing, but he did do something. Otherwise I'd have got a third *avertissement* and that would have been the end of me here". She was then summoned by Boulez.

"Pierre Boulez was very nice, we spoke in English.. Boulez said: 'Move across into the scientific sector and all will be well'. He was very understanding. I asked Boulez: 'Since the *avertissement* was unjust, if I behave well in the three months after moving, can the *avertissements* be cancelled?' and Boulez agreed. Later I realised that this must have put BD in a difficult position because *avertissements* are not supposed to be withdrawn once issued by the Administration. But anyway, it happened like that.. Boulez kept his word... Pierre is very charming..very good... (Later,) he came through to see somebody in a studio and he passed through my office and asked how I was.. It wasn't regular to do that, take off the *avertissements*. But I'd negotiated it with Pierre, you know.. it shows where the real power is. Then the funny thing is, the same summer, when Mitterand came to power, he decided to amnesty all the *avertissements* in the whole of the country!.. So I was amnestied along with how many thousands of others! (laughs) - a gesture of expansion, humanism". Boulez's help is here equated with the greater, national leader Mitterand's own humanitarian largesse. The secretary spoke of the resolution of the situation realistically, as follows: "And I realised that if Boulez told me to go down, I had to go down... If Boulez says that, you must go".

19. This should be seen in the context that, of those IRCAM French intellectuals who told me of their party political affiliations, almost all had voted Socialist in the previous general election, in 1981.

20. HM spoke further as follows of the history of his fraught negotiations over pay with the Administration. When he started at IRCAM in the early '80's he received just 4,500 fr. net a month, while tutors got 9-10,000. For several years he was been on six month contracts, and being an American without a proper work permit the Administration can always justify this insecure status - although employing him at all is, in fact, illegal. He gained a first rise to 6,800 fr., and having got his PhD, attempted to negotiate a better salary close to the tutors'. He was offered 9,500 fr. net, and took it believing this to equal the tutors' wage. "It turns out, I found later, that all the tutors make more than that, without PhD's and so on. The way (the Administration) plays (it is) by having all this secrecy.. That's the way the management plays itself against the workers!" [HM int].

21. The tutors were asking for in the region of four out of every six months for tutoring, and the rest for their own composing.

22. RIG provokes the Administration as follows: he is responsible for bringing in many squatters, for odd and unofficial technological deals; he resists doing bureaucratic paperwork, and spends a lot of money on transatlantic phoning. The general sympathetic understanding of RIG's attitude is conveyed in the following joke made about him. In written guidelines for IRCAM researchers on how to present themselves in the annual report, RIG's friend and junior HM gives the following imaginary reference to exemplify the form that bibliographies should take:

"..Pour une chapitre -

RIG (1999) - *Le chaos bureautique*, in: Marx, K. and Marx, G. (eds) *L'approche stochastique dans la bureaucratie française*, 10/18: Paris."

23. ID is the software director from CARL (Computer Audio Research Lab),

at the UCSD (University of California at San Diego) - the second major west coast computer music centre after Stanford. CARL has produced some of the most widely used computer music software, used for example by the IRCAM stage. ID is an ex-Stanford graduate, and a regular visitor to IRCAM, to which he brings the latest west coast American developments. NI is an ex-Bell Labs researcher who is now trying to make his way as an independent low tech computer music entrepreneur, as both a technologist (see Ch.9) and a commercial film music composer.

24. ARPA is the Advanced Research Projects Agency, the declassified part of the US military technology research apparatus.

25. NI continued, elaborating his philosophical and aesthetic differences from IRCAM: "What kind of offence is that?.. It's a blindness. It's politics again.. the kind of engineering politics that put fluorescent lights in here. I mean, you can't think creatively with fluorescent lights! You need incandescent. Fluorescents are sterile. You can't even have a sexy thought with fluorescents around! It's this building too: a cathedral to mind, without heart or.. all the other parts of the body too. It's no accident they get the music they get here! That's why I was able to do things at the (Bell) Labs: I brought in my own incandescent lamp (and) I'd turn off all the fluorescents.. These engineers: they put fans into everything that are so loud you can hardly hear the music! So I put a convection cooler into my synthesisers, modified them for that. Truly, it takes a musician to design a musical instrument - period".

26. The only significant mention of an IRCAM worker's distaste for the militarist links of computer music technology was told to me by the junior tutor who first spoke of the 4X Dassault deal. He said that the 4X designer, the Italian physicist BU, was deeply unhappy about IRCAM's partners in this deal.

Notes to Chapter 5

1. Examples of such overheard student sounds from the stage are given on Tape 1, set within IRCAM's most common soundscape: the constant, a-rhythmic tip-tap of the computer keyboard as someone programs away.

2. One researcher jokes that "BU (the 4X designer) has done a new program on the 4X called 'MusCon'!", at which all present collapse with laughter. 'MusCon' here has a double meaning: both *musique concrete*, implying that this kind of music is so routine that it can be churned out automatically by a 4X program with no human intervention; and 'con' meaning 'stupid' (or 'cunt') so that such a program churns out 'stupid music' (ie *musique concrete* is stupid).

3. This can be gleaned, for example, from this ambivalent quote by the British critic Bayan Northcott, who is previewing a major Schoenberg retrospective festival in London. In the quote Northcott also critically touches on what is often seen as the key characteristic of Boulez's genealogy: its unremitting high modernism. "Schoenberg may well have admired Schmidt as the one contemporary who continued to find fresh possibilities in their beloved Austro-German tradition seemingly

untroubled by the anxieties of modernism. But the Boulez view of history still lingers in some high places and it will be some time before we hear a Schmidt-Schoenberg festival" (The Independent 8.10.88).

4. One high director described their relation thus: "WV amplifies all that Boulez does and says, and he's also influential on Boulez. If Boulez says absent-mindedly 'Oh, that's a bit pinky!', WV will come along and say very forcefully 'That's red!'" WV is perceived, then, as Boulez's 'commissar', extremifying rather than modifying Boulez's perspective.

5. Table 5.1 is a crude measure, ignoring both the scale and length of pieces played (from large orchestral works to chamber music to tape pieces, from long to short, miniature works), and the size and prestige of the performance venue (from the grand and 'classical' setting of the *Theatre de la Ville* or *Theatre National de l'Opera*, to the modern *Grande Salle* of the CGP).

6. A story tells of the attempt to attract Ligeti to IRCAM - from Table 5.1, the most highly valued composer who has not worked there. Minutes of the Artistic Committee in May '83 tell of Boulez and the Artistic Director inviting Ligeti for dinner in Stuttgart, in order to persuade him to come and produce a tape at IRCAM for his new opera. The minutes continue: "Ligeti, at the start of the meeting, had the 'Stanford-ian' idea that the composer had to know everything about the computer before being able to work. By the end of the meal, he was convinced that this wasn't necessarily the case", and so agreed to come. The reassurance given to Ligeti is Boulez and WV's view, but it marks a controversial division within IRCAM since the tutors believe that to make the most of IRCAM's technologies composers do need some prior technological experience which prevents their being entirely reliant on tutors' help. In fact, the Ligeti visit never occurred because of a revealing administrative blunder. Ligeti was due to come later in '84, but when the time came those responsible had failed to make adequate contact and so the date of the visit simply passed - which caused much embarrassment.

7. See, for example, Fig.5.2 - another such 'poem' of Boulez's that opens the publicity brochure for IRCAM's 1982-83 season.

8. Thus, in 1978-79 there is a 'Berg Cycle' of 6 concerts centred on Berg and his contemporaries, and a 'Messiaen Cycle' of 3 concerts; in 1980-81, a Stravinsky festival of 7 concerts; in 1983-84, a series centred on Webern, the Second Viennese School and contemporaries. In 1981-82 there is a series devoted to 'Boulez's works: 1946-81'; while in 1983-84 Stockhausen enjoys 9 concerts called 'Stockhausen presents Stockhausen'. This basic canon is reinforced further by the content of IRCAM's courses in music analysis, and by its didactic video and record series. The analysis courses in 1980-81 focused on Boulez, Stockhausen, Ligeti, Webern; in 1983 on Webern, Stockhausen, Boulez, and a major lecture course on the Viennese School; and in 1984-85 on Ligeti, Messiaen, Carter, Boulez, Berg, Varese, Stockhausen, Berio, Ferneyhough.

9. The irony was not lost on RIG that he had ended up organising both the both the ICMC's official concert series, and the supposedly

'rebellious', anti-establishment 'Off'.

10. This 'open' *Espace Libre* was held significantly on a June holiday called '*Fete de la Musique*' (Festival of Music) set up by the Socialists, in which people all over Paris took the day off and played music on the streets.

11. The degree of urgent desperation stirred up by the *Espace* in outside musicians wanting to gain an IRCAM hearing for their music can be illustrated by the following incident from one of the concerts, as noted in my diary.

"HY and I sit together in the audience. We hear a violin sonata of a young American composer. HY has given an introduction: says he's an 'up and coming composer.. a pupil of Roger Sessions, more and more known'... As we sit listening, one seat apart from each other, a young Japanese man on my right suddenly gets up and sits between us. And while the violinist is playing he asks HY if he will listen to a cassette of his music and thrusts that and a scribbled envelope into HY's lap. He talks to HY while the violin continues, and his hands are shaking very nervously... Again, 5 minutes later the guy talks to HY... and when the piece ends he demands that he should play violin improvisation now, because his music is much better than this sonata. HY says: 'Wait, not now, we'll see about it later..' and deflects this guy's aggressive approach skilfully. About 10 minutes later, as PL starts up his talk, the Japanese guy gets up and stalks out very obviously, dramatically..." [BD].

12. Watching a young Parisian's music video one evening - with a loud, heavily rhythmic soundtrack like industrial rock music, to which some dazzlingly bright, abstract patterns made by computer graphics changed shape - I heard the Artistic Director say to HY: "What is this dreadful stuff? This awful music!", to which HY responded "It's a bit messy, but promising". The young man became a client of HY's.

13. The term used here is '*animation*': it has no English equivalent, and implies an event aimed at enthusing and informing a broad public.

14. Strangely, the 'openness' of the *Espaces* contradicted even HY's own private views since, despite including the music of amateurs and of IRCAM's junior workers in his events, HY once said to me that "only me and Boulez are really composers here at IRCAM" [BD].

15. As we see in Appendix 7 the Yamaha DX7, for example, is known for its innovative gestural control. It was the first widely available digital synthesiser to provide a sophisticated, piano-like touch-sensitive keyboard which could be programmed to control various parameters of the sound (eg intensity, vibrato).

16. One illustration of this attitude was the incident described in Ch.4.2.1 when a major commercial firm came to demonstrate their latest high cost system, only to be humiliated by the failure of their music transcription program, spotted by Boulez himself, which made the firm appear musically ignorant.

17. Another incident, however, suggests both a mutual suspicion and

industrial tension between the two sectors, and at the same time a growing respect from some IRCAM researchers for what can be learnt from commerce. A representative of the Yamaha corporation, in 1984 leaders of the commercial music technology sector, came to visit IRCAM to demonstrate their latest tiny CX synthesiser. The high Japanese executive took the machine through its paces. He could barely speak english, let alone french, but nonetheless carried with him all the time a pocket cassette recorder held at chin level on which he taped every exchange and question. The breakthrough with this machine was size: the extraordinary miniaturisation of a digital FM unit, held in a box just centimetres square under the small main body. Bemused and admiring of this tiny, powerful toy, the researchers gazed at its black casing. Finally, the American composer PL - who alone worked seriously with small commercial systems - could contain himself no longer. Defying the implicit etiquette of the occasion, he recklessly challenged the man to let them know how it worked: what was in the box? A pause, and the representative replied - "Ah... Japanese air!" The room broke into ironic laughter, and mystery was maintained. The story hints, then, at how IRCAM's dominant anti-commercial ideology conceals both rivalry with, and intense curiosity about, the commercial technology sector.

18. The concept of a 'work station' is that of a total working computer environment ready for use by an individual: one that is fully developed with the needs of the user in mind, and so with 'user friendly' software that is functional and appropriate for - in this case - musicians and composers.

19. The other performance-oriented project was QG's 4X project.

20. Another area of PL's work is writing programs for the Apple to enable it to 'accompany' a live player in realtime. PL has arranged several of his own simple pieces in this way, so that a live musician improvises upon a solo line, while the computer 'follows' the tune providing chordal accompaniment and, given the right cue, changes chord to suit the tune. This project is similar to QG's 4X project - also concerned with enabling a computer accompaniment to 'follow' flexibly and musically a live solo part. However, the resources of the two projects are vastly different: small Apple II's as opposed to the large 4X. Opinions at IRCAM vary as to how sophisticated PL's system is compared with the 4X-based work. PL maintains that his results are as good as, or better than, QG's; while some commentators, for example junior tutor WOW, find this ludicrous and argue that his work is inherently limited by the Apple's far smaller memory and power.

21. PL symbolises his marginality and distaste for IRCAM's bureaucracy by avoiding all normal daily contact and displaying a phobia for the place and its routines. At the start of '84 he was disdaining altogether to come into IRCAM by working on his system at home in his cramped Parisian room. He boasted of his freedom and independence: that he didn't need any of IRCAM's resources in order to do his work. However, in February PL decided to move back into IRCAM to work, and negotiated the use of a small, disused attic room at the very top of the old building. As he said, this room is spatially "the furthest away one could be inside IRCAM and still be in the place!". PL also eschews normal office hours, working at IRCAM from late evening until early

morning. He is a stalwart of IRCAM's vanguard, bohemian night culture; and his choice to work all night is clearly a lifestyle preference rather than resting on the technological alibi of overcrowded resources. PL's inverse timetable is, then, both rebellion against the institutional regime, and a positive delight in a 'jazzers' bohemian lifestyle. Due to accommodation problems and for bohemian convenience, PL began unofficially to use his attic room as a place to stay as well as to work. So he left other personal effects there in addition to his equipment - instruments, clothing, tapes, books, and a mattress to sleep on if he felt like it. He locked the room whenever he wasn't there, because the equipment that it contained - Apple II's, software, electronic devices - was his own property: unusual within IRCAM. Locking his room was also unusual and a concession from the building manager since, as we saw earlier, most IRCAM offices are kept unlocked.

22. One weakness of the 'ear' program, for example, involves pitch recognition, since it requires the player to hit a pitch very precisely. The program's pitch following device cannot make sense either of notes that are slightly off pitch, nor of 'glissandi' - slides between pitches, commonly used by string players for expressivity. So the programs do not run well with strings, and cannot deal with 'analog' or continuous pitch phenomena - one of the inherent difficulties with the 'discreet' bias of digital technology.

23. Another Acoustics project illustrates the rare exchanges between Acoustics and the rest of IRCAM. A visiting researcher, GW, came on a six month contract to make an acoustic study of piano and violin sound production. When his analysis turned out to be suitable for application, one of the Systems team (YI) used it to design a piano synthesis tool.

24. Multiphonics are the complex and expressive 'dirty' sounds, often involving clusters of harmonic and inharmonic pitches, which instrumentalists produce by departing from standard techniques of fingering, embouchure (for wind and brass) or bowing (for strings). For this research, ARI researchers collaborate with EIC players and other Parisian musicians that use these extended techniques.

Notes to Chapter 6

1. Thus, at IRCAM in 1984, the main psychoacoustician HM constantly entertained the desire to compose since he saw his work as generating compositional ideas, and other composers' use of his research disappointed him. Interestingly, a friend reported of him in 1987: "HM has given up on the idea of becoming a composer; he accepts that he's a good psychoacoustician, but that doesn't mean he's a good composer or can become one".

2. IRCAM musicians, rather than rejecting serialism outright, appear to see it as having had its time but as now simply outdated, as the following illustrates. One composer, on hearing a tape of a complex piano piece by another, commented humourously: "It's a bit like Babbitt, old fashioned stuff!". Babbitt is one of the leading American serialist composers - see Ch.9.

3. RIG ends a paper on this research as follows: "The results suggest some interesting.. avenues for composers. Purely timbral analogies are perceivable and their behaviour appears predictable from an underlying timbre space. Indeed, the concept of melodic transposition might now be extended from the domain of pitch to that of timbre" [IRCAM Rep.13, 1978].

4. The project, aimed at computer-aided analysis and synthesis of the underlying 'rules' of jazz improvisation, involved just two people, both outsiders and unpaid by IRCAM: a post graduate computer scientist, BUa, who knew nothing of music, and his supervisor, a French musicologist who had written a book on jazz phrasing. In May the project came before a music research meeting for assessment where, despite the backing of RIG, its legitimacy was continually questioned. The Music Research director said dubiously: "Is this really a music research project? How do you see it being generalised here?"

5. The first document was actually produced prior to the meetings by some from the group and fed into them, and the second was written out of the early meetings and discussed with Boulez.

6. HU writes: "...In the end the sound and the sound space are the microcosm and macrocosm of the same formal idea. This allowed me to create focalisations where the ear could take its bearings" (CMR:138).

7. HY writes: "...rather than...logical abstractions,...my musical spectra never copy natural spectra..and only use these as a base or inspiration for freely composed structures" (CMR:221).

8. CX writes, of Holler's compositional scheme: "'Arcus' is based on a 40-element series, which is used to control the evolution of pitches, time values and other parameters. It was York Holler's desire to preserve the unity of the composition by extending serial control to the transformation of the recorded material" (CMR:41).

9. Expert systems are 'interactive' programs based on a body of knowledge that is written into the program as a set of rule-following inferences, a hierarchical chain of reasoning. The user provides data which the program analyses according to the rules, supplying an answer which the user can then follow up by inputting additional or more refined data.

10. It is significant in this regard that two researchers (FA, MIO) who had come to IRCAM hoping to pursue work on man-machine interface, both actually working as high technical service directors, left IRCAM dissatisfied in 1984 to work elsewhere.

11. Specifically, FOK's position conveys the fear that IRCAM's production of large scale hardware is being attacked and may become obsolete; while hostility from his side towards music research is equally clear in his planning document which made no mention at all of a future role for music research within IRCAM.

12. Xerox's Paolo Alto Research Centre.

13. MC means here that the interconnected-speaker-system speakers in his room are always turned on, which is how he overhears *stageaires'* sounds and so judges their talent.

14. In line with his preference for popular, easy listening music, BU was also engaged in 1984 in setting up a record with a blonde actress who had starred in a Rohmer film, and who was currently a big success on French television as the star of a housewives' aerobics show.

15. It is interesting that this corresponds to the opposition between an 'analog', or continuous, versus a 'digital', or segmentedly stabilised, view of research and development.

16. It is important to be clear that these are ideologically associated oppositions, categories defined by difference that are linked together into charged semantic fields, so that the associations produce odd inaccuracies and irrationalities. For example, it is untrue that IRCAM hardware development requires no research, that it is more short-term to develop than software, or that it is primarily 'manual labour'; just as it is inaccurate to say that software is less 'realist' than hardware, or that it necessarily has a privileged relation with music and is, by implication in this scheme, less 'science' than hardware.

17. Lyotard argues that the self-legitimation by the quest for truth characteristic of science until the late nineteenth century has been 'delegitimised'. "What we have here is a process of delegitimation fueled by the demand for legitimation itself... an internal erosion of the legitimacy principle of knowledge" (1979: 39). He summarises the shift in legitimation thus: "...the goal is no longer truth, but performativity... The State and/or company must abandon the idealist and humanist narratives of legitimation... Scientists, technicians, and instruments are purchased not to find truth, but to augment power" (1986:46).

Notes to Chapter 7

1. The panel brings together some 5 composers, critics and musicologists chosen by the Artistic Director, who meet to judge outside composers through the scores or tapes that have been submitted, from which they select new talents to invite to the IRCAM stage or (rarely) to give a commission.

2. For example, minutes of a mid-1983 Artistic Committee record that 188 scores had been submitted to the Panel, while "few tapes have been presented, and the level of those evaluated by the Panel were on the whole low" [AC mins 25.5.83:2, my transl.].

3. The same visiting IRCAM composer, YY, recalled how the director of his music conservatory, hostile to YY's composition and disbelieving that YY could really imagine aurally the sound of his own scores, had tried to catch him out by playing a piece of YY's at the piano and inserting deliberate mistakes. YY had recognised the mistakes, and so proved that he could in fact 'hear' the music in his scores.

4. This is nowhere better exemplified than in Boulez's reverence for Klee and Kandinsky, artists who drew analogies with music in their concern with colour and form. The close interrelation between modernist music and the visual arts was, however, a more general characteristic, especially during the high period of abstract visual art, as I discuss in Ch.9.

5. At base, this involves the use of an operating system such as UNIX, and of an editor; but preferably, more advanced programming skills in relevant languages.

6. "The control structures available in most assembly codes are primitive... Assembly code remains closer to the computer's language than to the programmer's. Algorithms must be expressed in terms of what the machine is to do rather than in whatever terms might be natural to the problem at hand" (Scientific American Sept. 1984:62).

7. Interesting, too, is the content of some mnemonics: for example, the Formes program initially used the terms 'God', 'Father' and 'Son' to describe hierarchical classes of objects; by the 1985 version, this patriarchal terminology was modified to 'Parent' and 'Child'.

8. I have used the Cmusic patch language as an example of the complex character of computer music software; and, as mentioned in Ch.5, IRCAM software such as Chant and Formes is motivated by the desire to reduce the inappropriate technical and conceptual complexity of patch languages. However, to get this aim into perspective, it should be noted that *stageaires* found Chant difficult to use, as shown by the earlier anecdote concerning a Chant lecture, as did junior tutor KF (see App.9).

9. In electronic music the user had only a piece of electronic hardware to get to grips with, without multiple layers of software, and without the extreme miniaturisation of electronics found in digital hardware today. With some knowledge of electronics the user could try to manipulate electronic hardware manually and mechanically; and these crude manipulations were the basis, in the past, of aesthetic innovation with electronic instruments - for example, the manipulation of volume and tone to produce feedback and other kinds of distortion with amplifiers, or the addition of new valves or circuitry to hardware in search of interesting sound effects.

10. YR makes one-off experimental models of modified musical instruments for specific IRCAM projects: for example, he had crafted a beautiful microtonal keyboard for Boulez personally, according to Boulez's idea for a piece; and he had adapted a normal flute, attaching sensors to the keys, for a project in which the flute had to send signals to the 4X. (He is holding the flute in Photo 7.4).

11. This observation is indebted to Foucault's analyses of rationalisation and its effects on bodies (for example, Foucault 1977).

12. Foucault's analysis of the Panopticon as a model architecture for surveillance (1977) is brought to mind by this aspect of IRCAM's architecture.

13. The examples of computer mail in Fig.7.2 include the following. Message 1 is a reply from a researcher about when he would be available at IRCAM for an interview, its title quoting Shakespeare's 'etre ou ne pas etre' ('to be or not to be'). Message 2 from composer PL, signed 'Nervous Nellie' because of the state he was in weeks before his premiere, is in black American jazzers' argot. PL's message tells me how his programming work had suddenly taken off late the previous night, as usual with him - ('the shit finally started happening about 1.30am, my time to smoke, as usual'...). It reflects on 'how simple' programs should be, especially to be 'time-effective'; and ends by conveying the pleasure and fascination of cracking programming problems in his final remark, 'you could stay up forever'. Messages 3 and 4 are from me to a visiting consultant programmer, who as well as helping me with programming problems was flirting. Message 3 (signed 'Margaret Mead') answered previous mail of his teasingly: I am invited to correct his spelling, and remind him not to get careless with language 'just 'cause of the darned machine'; and, half seriously, I ask for help with how to delete old computer mail. I used also to request interviews with informants via computer mail: message 5, for example, is a request sent to a tutor in French; (this man was known to be politically sensitive to using French). Message 6 was sent by me to HY, for whom I had just done some simple programming work on the computer score for his next composition, shortly to be premiered. Message 4 thanks the consultant programmer for his help with doing that work for HY: I had problems which he helped to solve, the main one being that I had incorrectly used capital 'O's instead of noughts ('0') for the programming code which meant that it had failed to run. The second part of the message conveys my own feelings: about enjoying computing underground at IRCAM more when the weather 'out there' is wet, and my pleasure in 'merrily tapping and receiving mail all day!'.

14. The Array Processor was a new piece of hardware - a parallel processor - providing greater 'number-crunching' or calculating power, and so aimed at making demanding synthesis faster.

15. This is calculated at AV's labour for 3 months, and 3 tutors for 1 month each - 6 working man months - c.3,888,000 seconds at 6 hours' work per day, divided by 72 seconds - c.54,000.

16. The following two quotes convey this:

AV: "There was a month of soft writing before I could work at all (with) the first 'real thing': full of bugs, but it was there. That took about three man months: MC, XH and HM were all working on it..."

//

Q: "How much time did you put into tool design?"

HM: "In 1982 about 2 or 3 weeks full time just to build the instruments and then be consultant from time to time. MC did the equivalent on Chant, setting up the user routines.. And then AV mostly worked by himself. This time I did the additive synthesis instrument for the 4X: that was a good solid week, because we went through many different versions before we found what we wanted".

17. As we have seen, MC is Chant/Formes director, HM a psychoacoustician and junior tutor; while XH is an American computer musician visiting from Stanford who was substituting for an IRCAM tutor who was currently

away in the USA.

18. This is a joke referring to the fact that tritones are dissonant, unresolved chords commonly associated with the character of avant garde music. That the technology should automatically produce a tritone by mistake seemed highly aesthetically appropriate to IRCAM, and a bizarre coincidence!

19. One of AV's computer messages, concerning time, is set up as a 'race' between the VAX and himself 'till the end of times or the VAX crashes'; another takes the form of 'a nice chat' between AV and the intransigent automaton, the 'Vaxo Unmusical', which refuses to understand or recognise him, and ends again with 'System going down (crashing) in 30 secs!!!!'. Other messages speak of his sense of being 'nailed to' a terminal, of 'the sands of time'; and, most eloquently, AV uses a quote from Conrad: '..silence was being murdered by the atrocity of those vulgar sounds'.

20. Photo 7.25 shows a telling sign found stuck onto a disused music stand in the 4X studio. It is a table converting musical pitches into frequencies, and so recalling the traditional pitch basis of tonal (and atonal) music. The sign seems to betray a nostalgia for traditional pitch-based musicality, in the face of long abstract travails at the terminal. But it also implies that even users employing IRCAM's highest technologies may need reminding of this simplest and most basic acoustic information.

21. In fact, AV was quite fed up by this time and anxious that he had been made to look bad in front of Boulez and the IRCAM management; and his annoyance shows towards the end of the discussion. Overall, he oscillates between thinking of the visit as providing some 'useful' general knowledge, or as a total failure.

Notes to Chapter 8

1. The 'People' directory is a general UNIX service, the main all-purpose working directory employed constantly by all users of the VAX and the operating system. (It is mentioned, for example, in Fig.8.1 - the computer messages from Systems manager FA - as '/people').

2. The satirical poem in Fig.8.2 illustrates the teasing character of Systems team-researcher relations. It makes allusions to 'Formes' - the software research group considered by FA to be the heaviest users of the VAX - and to 'Born' - myself - as the means of analysing IRCAM's problems.

3. The story of replacing Systems manager FA when he left in mid 1984 illustrates the continuing interrelation of IRCAM's dependence on American technologies and skills. The problem for IRCAM was that the job demanded someone skilled in the UNIX operating system, and this was hard to find in France because UNIX had not yet been widely distributed there. UNIX was developed at Bell Labs for AT&T in 1969 and was ubiquitous in the big American universities, while updated versions were being developed at Berkeley. UNIX had also been distributed early by

AT&T to Australian universities to explore trial markets; hence the present Systems manager FA was a young Australian UNIX expert. This indicates the power of the major IT corporations to create international disparities, and to affect labour markets. At first, Boulez mandated Personnel to look for a French candidate to replace FA; but within weeks he sent FA urgently to the States to search for an American - (the 'Repons' premieres were looming, and the computing environment was in a mess). Within a short while, FA found the new manager BWr, a composer but also a UNIX expert from Berkeley. BWr, who risked a salary drop coming to IRCAM, was brought over to Paris and intensively courted on Boulez's orders: wined and dined at Boulez's expense, given drinks from Boulez's personal drinks cabinet. BWr bargained hard over his terms, and eventually came.

4. Servicing of technologies can be done by independent firms, but since the equipment is so complex, specialised, and its workings secret, the manufacturers and their agents usually do it and have virtual monopolies. Service charges are therefore enormous; they start in the first couple of years at c.10% of the purchase price and rise steeply thereafter. In this way the companies control the market and force customers to upgrade to the next machine. Thus it was that by 1983, DEC were demanding such high service charges for the PDP10 - (they charged 87,000 francs for a 3 month service, and another 21,000 francs just 3 weeks after) - that it was judged economic to buy the new VAX and close down the PDP10. DEC's financial and technological stranglehold are further confirmed by the fact that, despite IRCAM offering to give the PDP10 away to any institution that wanted it, none took up the offer: the DEC service charges were prohibitive.

5. Some of these technologies are no more than a couple of years old, yet they are being discarded. They are not disposed of but lie around as though suddenly useless and valueless.

6. This is one cause of the segmentation and differentiation of technologies, illustrated for example by the development of small systems by the Japanese: this is a way to evade the dependency stranglehold, and to take the lead in a different technological sector.

7. The Pedagogy director RIG, who was against this decision, described it thus:

"They decided to go with the PDP10, and to pour everything on the computer side into BU's work on his prototype. That was a crazy decision! If we'd got the Samson box, as I wanted, we'd have immediately had a working environment set up for music production... Also, it would have set up alternative criteria by which to measure and weigh up the 4X project and its standards. But it didn't happen for political reasons. Basically, Pierre decided to put everything behind BU: invest in his 'genius'.. Berio had a lot to do with all this too". RIG here raises the issue of whether it would not have been more musically productive to opt for a stabilised technological environment, for example by sticking with the much used Stanford technologies. (The Stanford CCRMA itself has largely stuck to its dedicated system and has evolved specialist software within that more stable environment).

8. The photo shows also how, within days, graffiti was scrawled across

the sign saying '*composez Francais*', or 'write this in French': a sign of tension over language use.

9. Just one record of IRCAM 'examples' had been released by 1984, seven years after the institute's opening.

10. The American Pedagogy director RIG, who arrived at IRCAM for the first time in mid 1977, told me of his astonishment to find IRCAM management neglecting to record the concerts; he got hold of a high quality portable tape recorder and himself taped as many as he could.

11. By 1984 it was urgently overdue for IRCAM to upgrade the recording studios, which had been equipped in 1976-77 with high quality analog equipment. Higher quality digital recording equipment had then been around for some years, and for IRCAM - a high tech computer music centre - not to be digitalised was an anathema. Indeed the question of moving over to digital technology had been around for several years, attracting conflict. Finance had not been forthcoming from the main budgets, and special bids were in process. In 1984 I was first told that 1.7 million francs had been found for digitalisation; but then that money disappeared. IRCAM finally got its first 24 track digital tape recorder in September 1984.

12. Some individual young IRCAM composers, especially those with previous electronic music or pop music experience - both of which may involve much aural, empirical studio-based aesthetic experiment - are far more aware of these studio production potentials, and employ them in their own composition: eg WOW, NP, KF, FLu. These composers are relatively marginal within IRCAM, or from the vanguard (but not all those from the vanguard have this approach).

13. As we have seen, computer music allows exploration of the movement of partials within one timbral 'object', of the fusion and then separation of partials, and of the movement or 'syntax' of timbral transformations. According to some of IRCAM's vanguard, these possibilities supercede old concepts of polyphony.

14. For example, visiting commissioned composer NO spoke respectfully of his tutor, JIG, as a composer and an equal.

15. We saw earlier (Ch.4) the clearest expression of this rebellion in 1984: the tutor JIG's fight for a new tutors' contract which would allow them several months a year for their own musical work using the IRCAM technologies: an agreement which aimed to establish the principle that some tutors are themselves composers whose composing needs should be respected; so that some of the tutors' time paid for by the wage should be usable for their personal creative labour.

16. Shortly after, BYV described with amusement some of the small gratifications that he derives from his tutoring for Boulez thus:

"Some people find it - you know, when we work together sometimes in a studio... I've found it's rather funny, that in rehearsal when people who look up to the great Pierre Boulez, and then all of a sudden I tell him: 'Hey, listen, go over there and play the piano!...' And they're listening and they're a little bit surprised 'cos, 'Who's this guy

telling, you know, Boulez what to do?!!'.. this kind of thing. But that's just because of the working relationship we have".

17. This was illustrated above, for example, by the informal help given to AV's project by several researchers/tutors not assigned to it, called in for their specific knowledge of the 4X, the DAC's etc.

18. For example, one music director-composer invited me after a few months to help him with some work on his piece. This man was thought to be secretive about his composing work with the 4X, so that to be invited to help him was a form of flattery taken as a signal that he was my patron. Jokes soon flew that I was his 'amenuensis', and two of the vanguard teased me by saying that my work for the director was a 'rite of passage' akin, they said laughing, to the "sacrifice of vestal virgins" [BD].

19. There are even ideological divisions within research groups. For example XU, one of the two main computer scientists from Chant/Formes, depicted himself as intellectually opposed to the other, his boss MC. XU said that where MC was above all a rationalist in his attitude to programming, XU saw programming as an art, interpretive and inexact.

Notes to Chapter 9

1. I draw upon the following as sources for modernism and the avant garde (some as mentioned in Ch.1): Poggioli 1982, Anderson 1984, Haskell 1983, Shapiro 1976, Burger 1984, Laing 1978, Crow 1983, Calinescu 1987, Hughes 1980, Jameson ed 1977, Buchloch et al 1983, Frascina 1985, Wollen 1987, Williams 1988, Huxtable 1983, Greenberg 1961, Guilbaut 1983, Gombrich 1966, Whitford 1984, Gay 1968, Willett 1978, Apollonio 1973, Vitz and Glimcher 1984. On modernism and the avant garde in music: Rosen 1976, Neighbour et al 1983, Griffiths 1978, 1979, 1981, Adorno 1973, 1978, 1984, Boulez 1971, 1977, 1986, Cott 1974, Whittall 1988, Smith Brindle 1987. On post modernism: Foster 1985, Jameson 1984a and 1984b, Lyotard 1984, Huyssen 1986, New German Critique 33 1984, ICA 1986. And on post modernism and music: Nyman 1974, Cage 1969, Rockwell 1984, Manning 1985, Griffiths 1978, 1979, 1981, 1985, 1986, Emmerson 1986.

2. Anderson (1984) has warned against the tendency to treat modernism as unitary, when it spans a variety of aesthetic currents, and was unevenly distributed both temporally and geographically (1984:102-3). Yet I will argue, as in fact does Anderson himself, that there are certain common, defining features or 'co-ordinates' of modernism.

3. The following three sources all discuss negation as a central feature of modernism. "The avant garde looks and works like a culture of negation" (Poggioli 1968:107). "The fact of Art, in modernism, is the fact of negation" (T.J.Clark in Frascina 1985:59). "We can see the radical difference between the strategies of negation within modernism and within the avant garde. Modernism may be understandable as an attack on traditional writing techniques, but the avant garde can only be understood as an attack meant to alter the institutionalised commerce with art" (Schulte-Sasse in Burger 1984:xv).

4. The development of a 'machine age aesthetic' is summarised by Wollen as follows: "The first wave of historic modernism developed an aesthetic of the engineer, obsessed by machine forms and directed against the lure of the ornamental and the superfluous... An art of the leisure class, dedicated to conspicuous waste and display, gave way to an art of the engineer, precise, workmanlike and production-oriented. This trend, which grew alongside and out of an interpretation of cubism, culminated

in a wave that swept across Europe: Soviet constructivism, the Bauhaus, De Stijl, purism, *Esprit Nouveau*. All of these were variants of an underlying functionalism which saw artistic form as analogous to (...) machine form, governed by the same functional rationality" (Wollen 1987:5). Thus avant garde interest in technology and science fed later into the new functionalism in design and architecture associated with the modernist Bauhaus movement in Weimar Germany, and with modernist architecture at large. But modernist fascination with technology and science must first be seen as autonomous forces, separate from functionalism.

5. Seurat related his development of pointillism to scientific theories of colour vision. In the same period Cezanne was jettisoning linear perspective, upon which painting had been based for centuries, in attempting to convey the materiality - the sense of solidity, depth and colour - of his subject matter (Gombrich 1966). The general appearance of a close interest in modern science by modernist artists is the theme of work by Vitz and Glimcher (1984).

6. The leftist Soviet art groups argued that post-revolutionary art must seize on the new mass art forms: film, photography, the new graphic arts (posters, magazines), murals. In a 1920's text, Soviet poet Mayakovsky wrote of the process of writing poetry as a "manufacture" (Laing 1978:32).

7. Russolo wrote: "We enjoy creating mental orchestrations of the crashing down of metal shop blinds, slamming doors, the hubbub and shuffling of crowds, the variety of din, from stations, railways, iron foundries, spinning mills, printing works, electric power stations.. We want to attune and regulate this tremendous variety of noises harmonically and rhythmically" (Apollonio 1973:85).

8. Poggioli stresses the avant garde's rhetorical borrowing of terms associated with scientific discourse: the importation of concepts such as artistic 'experimentalism', 'research', the art 'laboratory', the use of quasi technical names for artistic styles ('pointillism', 'cubism', 'vorticism'). Poggioli talks of the scientism of the avant garde as part of the "mechanical-scientific myth (which) is one of the most significant ideological components of our civilisation... Avant garde scientificism remains a significant phenomenon even when one realises that a purely allegorical and emblematic use of the expression 'scientific' is involved... Avant garde scientificism is the particular expression not only of the cult of technique, but also of that of general dynamism which is one of the idols of modern culture and was elaborated into a cosmic myth by romantic philosophers" (Poggioli 1982:139).

9. As we have seen (Ch.2, App.4), the radical political connotations of the avant garde derive first from the origins of the concept of the avant garde in early French socialism (Manuel 1956, Shapiro 1976, Poggioli 1982). These origins account for the double political and artistic meanings of 'avant garde', and the association from the mid 19th century of artistic 'radicalism' with radical politics (Poggioli 1982). Yet Poggioli charts a gradual shift in the French avant garde over the 19th century such that, by the 1890's, avant garde artists had

turned to anarchism and libertarianism, so ending their uneasy alliance with socialism. Poggioli argues that the political meaning of avant gardism was ascendant over the artistic from the 1830's until the 1890's; while the 1870's saw a more equal alliance between political and artistic 'rebels', as for example in Bakunin's short-lived Swiss anarchist-libertarian periodical called '*L'Avant Garde*'. But already by then, French artists were showing ambivalence towards the strictures of any politics other than anarchism and libertarianism. From flirtations with socialism, they turned defiantly instead to identify with Parisian Bohemia, calling themselves 'decadents' - a term of abuse by socialists. By the 1890's, Poggioli argues that the two avant gardes had become divorced; and the secondary, artistic-cultural meaning became primary, retaining powerful connotations of political radicalism. Other historians (Williams 1988, Shapiro 1976) similarly depict the politics of the avant garde as primarily nihilist, anarchic and libertarian.

10. A second historical factor in the radical political connotations of modernism is the wider political context of early European modernism in the mid 19th and early 20th centuries: the influence of a climate of social revolution, and above all the effects of the Russian revolution. Yet Anderson notes cautiously that "the possible revolutionary outcomes of a downfall of the old order were...still profoundly ambiguous" (ibid:104-5), so that modernism's political affiliations were labile and unfixed. In fact, as Anderson agrees, where it has been politically aligned, modernism has been trans-political: capable of affiliation with both left and right politics. Anderson makes this point in discussing the modernist fascination with technology. "It was not obvious where the new devices and inventions were going to lead. Hence the - so to speak - ambidextrous celebration of them from Right and Left alike - Marinetti or Mayakovsky" (Anderson 1984:105), ie Italian futurism (that became aligned with Italian fascism) or leftist Soviet constructivism. Thus modernism, like romanticism before it, was capable of affiliation with various politics, right and left, and had no inherent left bias; indeed it was subject to left critique (for example from Lukacs).

11. This third historical factor in the radical political connotations of modernism - its suppression from the early 1930's in Nazi Germany and Stalinist Russia - had powerful effects on its post-War meaning. Under both regimes modernist art, including serialist music, were banned as decadent. This censorship, and its identification with totalitarianism and fascism, became the basis of the post-War championing of modernist art in the West and in its reading as an expression of progressive rebellion against those forms of domination. This is how modernism came to be perceived post-War as inherently anti-totalitarian and anti-fascist: a perspective nowhere better argued than in Greenberg's famous paper '*Avant garde and kitsch*' (1961). The process is analysed by Guilbaut (1983), who charts the post-War reading of American Abstract Expressionism, despite its political neutrality, as embodying a critique of Stalinism: a factor which Guilbaut suggests helped to consolidate its newly hegemonic position in the 1950's as the leading international visual avant garde (Guilbaut 1983).

12. To expand, historians cite two related aspects of the avant garde phenomenon. First, a new relation between artists and the public: Haskell notes the appearance of an unprecedented degree of

institutionalised hostility and incomprehension towards a number of great painters (the impressionists, Van Gough, Seurat). Haskell says that earlier innovatory painters had often been eagerly acclaimed in their time (he cites Caravaggio, Watteau, David). Manet's career epitomised the phenomenon: the Academy initially mocked his work; late in his career he was grudgingly accepted and given a second class medal and the *Legion d'Honneur*. This codified a now familiar cycle of public hostility to modern art, followed later by reappraisal and rapprochement - with the art critic as mediator.

Related to this, and central to the construction of that hostility, was artists' self-definition around a double antagonism towards both commerce and the bourgeois market, and towards academicism and the canons of official art (Williams 1988, Anderson 1984, Poggioli 1982, Shapiro 1976). Instead of this, artists espoused an uncompromising ethos of progress and subversion of the status quo: above all, the need to be beyond the immediate comprehension of these or any audiences. For Haskell the concept of the avant garde centres on the notion that there is "some specific kind of art that is 'ahead' of others, an art that by definition would not run the risk of being contaminated by too early a welcome" (Haskell 1983:24). There was nothing natural about the transition to this view, which was at first troublesome; thus, Gauguin criticised attempts to be always ahead of the latest style. But eventually it became internalised as artists' intentions, so that Kandinsky claimed that the merit of great art had always lain in its being out of reach of ordinary, immediate understanding; while Seurat wrote frantically "the day when everyone makes use of our technique, it will have no value and people will start looking for something new" (ibid:25). Haskell says that the force of the new concept of the avant garde can be appreciated by "looking at the frenzied attempts made by artists on the one hand not to be liked too soon.. and on the other to have anticipated the future" (ibid:25).

13. In early modernist painting, the influence of non-western art is clear in painters such as Degas, Gauguin and Toulouse Lautrec (Gombrich 1966). By contrast, Crow (1983) discusses the influence of mass popular culture. He shows how the impressionists and post-impressionists, in their search for new taboo subject matter to shock the bourgeoisie, made reference to urban popular culture; hence the centrality in their work of representations of the 'other' - the lives and leisure of the urban working class, the paraphernalia of mass culture. However Crow describes a play-off between this new subject matter and the new modernist formal experiment. Both were equated, for some painters at some times, with radical political allegiances; yet not always. Crow shows how, gradually, formalism won out over subject matter, while subject matter became simply a carrier of formal play, as with cubist collages incorporating the debris of cafe life. Thus reference to popular culture and its critical meanings gave way to a purely formalist modernism characterised by self-referential abstraction.

14. Adorno's polemical attacks on the degraded nature of mass culture and popular music (1978), and writings by Greenberg such as 'Avant garde and kitsch' (1961), reveal that beneath the modernist assertion of 'absolute difference' lies a more active antagonism towards, and repudiation of, the culture and tastes of the 'masses'.

15. This recalls Williams' (1963) and Burke's (1981) analyses of how, in the discourse of 19th century romantics and nationalists, the urban 'mass' were deprecated and condemned by contrast with an imagined authentic rural 'people'. It seems that this split between a denigrated 'mass' and an idealised authentic rural or primitive (non-western) 'people', with roots in romanticism, remains characteristic also of modernism. Early and later modernists, like the romantics, have found it easier to idealise an exotic 'other' than the nearer urban 'mass'.

16. According to this principle, each pitch in the series has equal importance, and is dependent upon its position relative to the other 11 notes.

17. Adorno advocates the negation inherent in Schoenberg's serialism as follows: "In the process of pursuing its own inner logic, music is transformed more and more from something significant into something obscure - even to itself... Advanced music (ie serialism) has no recourse but to insist upon its own ossification without concession to that would-be humanitarianism which it sees through..as the mask of inhumanity. Its truth appears guaranteed more by its denial of any meaning in organised society.. than by any capability of positive meaning within itself. Under the present circumstances it is restricted to definitive negation" (Adorno 1973 (1948):19-20).

18. Controversies of the period between the post serialists illustrate the dominant scientific discourse through which they conceptualised music. Babbitt, for example, criticised the Europeans for insufficient mathematical rigour in these terms: "Mathematics - or, more correctly arithmetic - is used not as as a means of characterising or discovering general systematic, pre-compositional relationships, but as a compositional device.. The alleged 'total organisation' is achieved by applying dissimilar, essentially unrelated criteria" (Griffiths 1981:93). He advocated a more unified total serialism. Whereas Xenakis criticised total serialism for complex incoherence: "(It) destroys itself by its very complexity; what one hears is in reality nothing but a mass of notes" (ibid:110). Xenakis' solution was to improve the mathematical infrastructure, by bringing the laws of statistics, probability and calculus into compositional practice.

19. The vanguardist, evolutionist character of Varese's philosophy, the rhetorical and even poetic nature of his views on science and music, are here illustrated by a quote from a 1936 lecture: "The emotional impulse that moves a composer to write his scores contains the same elements of poetry that incites the scientist to his discoveries. There is a solidarity between scientific development and the progress of music" (ibid:68).

20. It is worth contrasting these developments with the one significant, yet confined, expression within pre-War musical modernism of a non-formalist critique: that is, the work of composers Eisler and Weill. In Weimar Germany in the late 1920's and '30's, their collaborations with Brecht were founded on an engagement with the social and political functions of culture, informed by wider cultural political debates between marxist intellectuals. Their approach contrasts particularly

with Adorno's advocacy of pure serialism. With Brecht, Weill and Eisler advocated the attempt to borrow and subvert the aesthetics of popular music in order to reach a popular audience: both strategies absent from mid-century mainstream modernism and later associated with post modernism. At a formal level, the broader debates aligned Adorno, Brecht and Benjamin for modernism, with Lukacs against. But the most significant conflict was that between Adorno and Brecht over the limits of a purely formal cultural politics. Brecht's ideas of a theatrical practice 'allied' to popular tastes but making them strange, drawing the popular audience in especially through close reference to their own musics, are the basis of his musical 'epic theatre' work with Eisler and Weill. These experiments in a critical musical populism, and Weill's work in particular, remain an extraordinary example of a politicised modernist intervention in popular music; an intervention so successful that when he later arrived in the USA, alone of all modernists, Weill 'went over' completely to the popular song that he had been parodying and became a composer of film music and Broadway musical. Compared to the developments outlined, and the increasing legitimisation of post serialism as shown by links to official culture and to the academy, the work of Weill and Eisler remained relatively marginal and unconsolidated.

21. According to Cage, "The opposite and necessary co-existent of sound is silence... Therefore a structure based on durations... is correct (corresponds with the nature of the material) whereas harmonic structure is incorrect (derived from pitch, which has no being in silence)" (Cage quoted in Nyman 1974:28). Nyman notes that in this Cage was disdaining the 'pseudo-logics' and methodological strictures of serialism and advocating a new, radical 'materialism' based on the nature of sound itself, a direction also taken by followers such as Feldman. Cage's disparaging remarks on the primacy of pitch thus represent a direct attack on serialism, derived as it was from a logic of pitch.

22. Thus in the experimental tradition, rather than music being the delivery of a perfect experience to the audience, the experimentalists called for interactive performance, for audiences to be active and participatory, for fluidity between the roles of composer/ performer/ listener. Experimental scores typically set up series of tasks, actions, games and described performance situations and strategies, rather than pre-determined sonic outcomes. Performers were expected to bring initiative, experience, to explore their active subjectivity. Audiences would be thrust into the role of performer, as in these 1960 pieces by the composer LaMonte Young, a member of the neo-dada experimental group Fluxus. "In 'Composition 1960.. No. 4' the audience is told that the lights will be turned off for a time; the lights are switched off, and at the end an announcement may (or may not) be made 'that their activities have been the composition'. 'No. 6' reverses the performer/audience relationship - performers watch the audience in the same way as the audience usually watches the performers... All these pieces may be of any duration" (Nyman 1974:71). In Cage's infamous piece '4 mins 33 secs', nothing at all happens for the duration of the piece apart from the pianist sitting at the piano, thus highlighting the minimal requirements and ritual nature of performance.

23. Greenberg articulates this view as follows: "Aside from what was

going on inside music, music as an art in itself began at this time to occupy a very important position in relation to the other arts. Because of its 'absolute' nature, its remoteness from imitation, its almost complete absorption in the very physical quality of its medium, as well as because of its resources of suggestion, music had come to replace poetry as the paragon art. It was the art which the other avant garde arts envied most, and whose effects they tried hardest to imitate. Thus it was the principal agent of the new confusion of the arts... But only when the avant garde's interest in music led it to consider music as a method of art rather than as a kind of effect did the avant garde find what it was looking for. It was when it was discovered that the advantage of music lay chiefly in the fact that it was an 'abstract' art, an art of 'pure form'" (Greenberg (1940) in Frascina ed 1985:41).

24. This ranged from Rzewski's treatment of the simple Chilean revolutionary song 'The People United Will Never Be Defeated' as the basis for a set of complex, quasi-serialist piano variations; to Cardew's founding of a maoist pop group, called 'People's Liberation Music', which set didactic lyrics to wooden imitations of current pop. The results were often uncomfortable and cerebral aesthetic compromises.

25. The most extreme example was the maoist Scratch Orchestra started by Cardew in 1969, in which the performer's role was democratised to the extent that anyone motivated to come together, whatever their skills, could play in symphonic works. Concerts were demystified and took place anywhere: in town halls, pubs, playgrounds, weddings. The Scratch Orchestra constitution cited the 'Research Project' - learning through direct experience - as an obligatory activity for all members, to ensure cultural expansion. Nyman says: "The orchestra was the embodiment of certain educational, musical, social and ethical ideals", and Cardew's view was that the music "fosters communal activity, it breaks down the barrier between private and group activity, between professional and amateur - it is a means to sharing experience" (Nyman 1974:113-4). This attempt to demystify and collectivise musical experience became a model for later similar groups (eg, in Britain, the Portsmouth Symphonia, Ross and Cromarty Orchestra).

26. Cardew saw self-discipline as central to AMM's work: "Discipline is not to be seen as the ability to conform to a rigid rule structure, but as the ability to work collectively with other people in a harmonious and fruitful way... Self-discipline is the necessary basis for the desired spontaneity, where everything that occurs is heard and responded to without the aid of arbitrarily controlled procedures and intellectual labour" (Nyman 1974:107). MEV had a flexible membership around a core of four (Rzewski, Teitelbaum and others), and used 'compositional scaffolding' within the improvised context. Their democratic anti-elitism was expressed by Rzewski thus: "(The) act of music-making is self-exploration within and of a collective... We are all 'musicians'. We are all 'creators'" (ibid:111). Rzewski did not deny the skills of trained musicians, but gave them a teaching and organising role: "If you are a strong musician mostly do accompanying work, that is, help weak players to sound better. Seek out areas where the music is flagging and organise groups" (ibid:111).

27. Neuhaus explains his work and ideology as follows: "I am interested

in.. locating (composition) in space, and letting the listener place them in his own time.. (The) idea is to transport the music of the concert to the public space... I'm not interested in making music exclusively for musicians.. I am interested in making music for people" (Nyman 1974:150). Nyman says that Neuhaus' piece "'Drive-In Music' was an attempt to improve the environment for motorists by establishing areas of sound, which can be heard only through an AM radio, along a mile of.. roadway. These would (be).. available 24 hours a day for anyone driving along that road. A number of low-powered radio transmitters are set up by the roadside in such a way that their areas of broadcasting overlap, so that at any one moment the listener (driver) hears a combination of sounds, which changes according to how one drives through the area" (ibid:88).

28. Thus, since the 1970's a few post modern composers (eg Glass, Reich, Anderson, Nyman), influenced by close encounters with jazz and rock, have tried to cross the divide into popular music and market their music commercially: a move which the post-serialists continue fundamentally to disdain. This has been seen as a final post modern bid away from modernism, and towards overcoming the 'otherness' of and separation from commercial culture and music. However, this trend has been exaggerated by commentators (Rockwell 1984, Jameson 1984a). There remain significant aesthetic and socio-economic differences between the post modern and pop. Composers such as Glass and Nyman are not successfully integrated into popular music, nor is that their aim. They want to infiltrate that market while retaining their 'serious' art music status, their high cultural bases and sources of legitimation. Glass's operas, for example, are produced at the Metropolitan Opera in New York, at the British ENO; Nyman's at the ICA in London. So this post modern strategy is more accurately one of diversification based on antagonism to, but inclusion within, the spheres of legitimate culture.

29. It is striking that some of the main elements of experimental music practice - improvisation, live group work, the empirical use of small, commercial electronics in performance - were pioneered in the jazz and rock of the 1950's and '60's. While at another level, the politics of experimental music appear similar to those of the advanced black jazz of the '60's. Its musical collectivism, for example, was pre-figured by the Chicago black musicians' cooperative, the Association for the Advancement of Creative Musicians (AACM), which became a model for later progressive, cooperative music organisations (see Born 1987: 70-71). Yet these influences are largely unacknowledged, reflecting perhaps their status as deriving from an 'other' culture.

30. Cage is commenting on the state of the avant garde in 1958: "The vitality that characterises the current European musical scene follows from the activities of Boulez, Stockhausen, Nono, Berio etc. There is in all this activity an element of tradition, continuity with the past.. whether in terms of discourse or organisation... However, this scene will change. The silences of American experimental music and even its technical involvements with chance operations are being introduced into European music. It will not be easy, however, for Europe to give up being Europe. It will, nevertheless, and must; for the world is one world now" (Cage 1969:74-5).

31. Interestingly, as mentioned in Ch.2 and App.4, Guilbaut (1983) analyses a very similar process, and its rhetorical basis, in the visual arts during the 50's and 60's: ie the establishment of American Abstract Expressionism during the 1950's as the first 'truly American' national style, followed swiftly by its assertion as the leading international avant garde.

32. This may be linked to subjects' unspoken ambivalence about the industrialisation of the 4X by the defence industry, and so the questionable networks within which advanced large system research circulates. In Ch.4 we saw that this was a suppressed subject not openly aired, and that only a visiting American from the UCSD computer music centre discussed at length the conflict he felt, as a Quaker, over these direct militarist links in high tech, high level computer culture.

33. Boulez says, reflecting on the Zappa experience: "When you approach another culture..looking at it from outside, you miss or misspell the laws. But I find that these misunderstandings are often very fruitful, since what you see in another culture is what you want that other culture to reveal about what you yourself are doing and searching for" (ibid:14).

34. RIG recalled this fuller exchange with Boulez (confirmed by another witness): "Boulez said to me 'Well I see you've got hold of these Apples - good luck with them! But don't expect me or IRCAM to give you any support or money'... It's because of that old thing, Pierre sees these things as for '*la grande public*', and so by definition not for IRCAM".

35. This is illustrated, for example, by the following doodle that I found printed out from an Apple Mac and lying around the Systems team room soon after they arrived: "*La Fabuleuse Histoire d'Apple - Il etait une fois deux passions de micro-informatique qui vivaient dans la 'Vallee du Silicium' en Californie dite du nord. Ils imaginent un petit ordinateur destines aux enthousiastes...*" ("The Extraordinary Tale of the Apple: Once upon a time there were two passionate micro-computing fanatics who lived in 'Silicon Valley' in Northern California. They imagined a little computer destined for enthusiasts..." [my transl.]).

36. NI offered to build me a modified Casio VL Tone for about \$50.

37. NI had taken the modified VL Tone to Casio's headquarters in New Jersey; and when he played it to a high Japanese manager, the man had backed up in horror against the wall. The company had been completely uninterested in changing the machine, and as much as offered to pay NI to take the machine away and bury it. NI's explanation was: "They hated the aesthetic: the raunchy and stronger sounds coming out of it".

38. On the psychoanalytic concept of splitting, see Laplanche and Pontalis 1973, Hinshelwood 1989, Rycroft 1972. Laplanche and Pontalis discuss splitting as follows. "Splitting of the object: Mechanism described by Melanie Klein and considered by her to be the most primitive kind of defence against anxiety: the object.. splits into a 'good' and a 'bad' object" (1973:430). And on the related Kleinian concept of the 'paranoid-schizoid position': "The 'good' and 'bad' objects which are the outcome of (this) splitting attain a relative

independence of one another... The 'good' object is idealised: it is capable of providing unlimited, immediate and everlasting gratification. Its introjection defends the infant against persecutory anxiety.. The 'bad' object, on the other hand, is a terrifying persecutor; its introjection exposes the child to endogenous threats of destruction. The ego, because of its lack of integration, has only a limited tolerance of anxiety. As means of defence, aside from splitting and idealisation, it uses denial (disavowal), which seeks to divest the persecuting object of all reality, and omnipotent control of the object" (ibid:298-9).

39. The distinction seems related to the different constructions of what we might call aesthetic time - the time involved in the full production, circulation and consumption cycle - in the spheres of modernism and of popular culture. Modernist aesthetic time, as we saw earlier in relation to AV's production visit (Ch.7), is very slow compared to the extremely rapid turnover in popular cultural aesthetic time. In order to keep up and experience the full pleasure and thrills, popular culture consumers have only to invest in an aesthetic choice for 'so long'. They absolutely do not want to get involved in deciding on, and attaching to, eternal or 'sublime' values. This would get in the way of the enjoyment of speed and transition in popular culture: one of its most stimulating qualities. I suggest that it is this question of time, of an aesthetic of motion, of attachment and then transcending that attachment, an aesthetic of accumulation - expressed in simple material form in the shopping for and buying of commodities (investing a little, not a lot) - which marks the absolutely different aesthetic gratification of popular culture. But this difference of aesthetic time does not in itself imply a more superficial attachment to popular culture. (However for a negative view of this quality of popular music see Attali (1985), who describes its obsessional consumption as 'stockpiling').

40. Thus FLu, although the son of a famous East European composer and himself a composer, retained the status of squatter and short contract technician.

41. A notable example (mentioned in Ch.2) is HF, one of IRCAM's star American all-rounders, who left after bitter aesthetic disputes with Boulez over HF's music, which Boulez scorned as light. As we saw, HF moved on to become head of computer audio for IRCAM's commercial rival, Lucas Film.

42. For example, the 1984 ICMC at IRCAM was mainly concerned with big system research, and had just one small section devoted to 'affordable systems' which was treated condescendingly by many high level researchers.

43. Examples of these views on the 'information' or 'post industrial' society include, on the utopian side, the work of McLuhan, Masuda, and on the dystopian side that of Baudrillard, Bell.

44. I can provide only a summary justification of this assertion, illustrating with short tape examples (Tape **). There are, I suggest, four major dimensions of aesthetic difference between musical modernism and popular music. They are: popular music's basis in tonal or modal harmony or melody; its regular, repetitive, pulse and pattern based

rhythmic character; its broader use of repetition at various levels of the whole - in rhythm, melody, harmony, or form; and the use of improvisation - from micro improvisations, as with instrumental and vocal expressive inflection, to macro, extended improvisations, whether in solos or completely improvised pieces. (On popular music aesthetics see Chester 1970, Keil 1966, Middleton 1983). Any one, or combination, of these elements can be sufficient to identify the broad aesthetic character of popular music. (For example avant garde jazz, sometimes considered modernist, has the free improvisational element of popular music in a way very different to the constrained modernist use of improvisation). By contrast, the modernist aesthetic eschews tonal or modal bases; it is arhythmic or rhythmically irregular, and avoids pulse and sustained pattern in favour of calculated durations and complex irregular patterns; it avoids perceptible or simple repetition; and improvisation, if brought in, is highly constrained and determined by compositional directives. The examples on Tape 1 (A.4 to A.13) demonstrate, aurally, the contrasts and similarities between: IRCAM modernist music (Boulez); IRCAM 'post modern' music (Machover, Manoury, Barriere, and Vinao); external, non-IRCAM post modern (experimental) music (Glass, Reich, Rzewski, Nyman); and external popular music (Stevie Wonder, Michael Jackson). My analysis is summarised in Fig.9.3. The examples show, above all, how dissimilar the music of IRCAM's young 'post modern' composers is not only to mainstream popular music, but also to that of the non-IRCAM post modern, experimental tradition, which can be heard to be aesthetically closer to popular music (with greater tonal reference, rhythmic basis in pulse, repetition etc).

45. The article on Braxton, in The Guardian (24.6.88:32), leads up to IRCAM as follows: "Too subversive of jazz improvisation and orthodox swing to become a neo-Coltraneist hero; too interested in jazz to be a conservatoire cult figure; a compromised would-be European to some black Americans and a black man with no sense of rhythm to some whites, Braxton has fitted no niches. He recalls with some irony how Boulez welcomed Frank Zappa to perform a symphonic work at IRCAM, but that such an opportunity would still be denied to him".

46. The one exception, Boulez's American tutor and 4X Soft director BYV - who works very closely with the 4X and advocates that IRCAM should develop the 'Rolls Royces' of computer music - has become strongly identified with Boulez and Europe, as shown by his recently taking out French citizenship.

Notes to Chapter 10

1. It is interesting that WI used almost exactly the same phrase as PL, IRCAM's 'dissident' black American composer, to convey his sense of distance from IRCAM's dominant culture. Both had chosen to inhabit studios hidden away on the top floor of the old IRCAM building; and, similarly to PL, WI described this as being "the furthest away you can be from IRCAM and yet still be inside the place!". WI expressed his musical tastes to me when he enquired about what music he could go and listen to on a forthcoming visit to London. He asked: "Are there any good musicals on in London now? or shows?... 'Starlight Express' or 'Chess'? How's 'Cats'? Have you seen it?"

Figure 9.3 Guide to aesthetic differences between IRCAM and non-IRCAM music, as on Tape 1 (A.4 - A.13): (as discussed in Ch.9 Note 44)

IRCAM	IRCAM	NON-IRCAM	(NON-IRCAM)
MODERNISM	POST MODERNISM	POST MODERNISM	POPULAR MUSIC
Boulez	Machover	Glass	Wonder
	Manoury	Reich	Jackson
	Barriere	Rzewski	
	Vinao (non-IRCAM piece)	Nyman	

2. See Roads (1980) pages 19-20 for outlines of several such projects: for example, J.Snell's project on the computer modelling of C.P.E.Bach's compositions, S.Haflich's similar project to devise a computer model of the (Chomsky-an) 'competence' at work in Mozart piano sonatas, or D.Levitt's attempt to make a generative model of jazz composition. Once again, Roads qualifies: "While not purporting to be a cognitive theory of what human musicians do, (they do) bring into the open the different dimensions and levels of organisation required for modeling (sic) even the more understood musical forms" (ibid:19).

3. This variety of applications of the Formes program is described in a paper given at a CGP conference in September 1985 (IRCAM, Rodet 1985).

APPENDICES

Appendix 1 Interview and other tapes

Most taped interviews last between 45 and 90 minutes. With some key informants, the cumulative serial interviews last from 2 to 6 hours. The interviews were semi-structured and expansive, and covered questions on the following: informants' work and functions at IRCAM, salary, career history; education, family and musical background, and (occasionally) political affiliations; musical culture and tastes; technological philosophy and experience; attitudes towards IRCAM developments and controversies. Although I did not obtain exhaustive information on each subject's social, economic or cultural profile, nor did I neglect these issues; so that I gained a general but instanciated impression of the range and distribution of, for example, subjects' class, educational and musical backgrounds for the range of the institute, from mail man to directors.

Tapes of educational classes, meetings and discussions tend to be of poor quality, since the speakers' voices are low and far away. Nonetheless, some were possible to transcribe and use. Regarding the tapes of IRCAM related music, some are poorly taped from work in progress or live performances, while some are copied from good recordings.

NB: Interview and meeting tapes are listed here as they were collected chronologically from January to November 1984, and then during later return visits.

Names of well known figures, or of composers, writers, researchers whose authorship should be acknowledged, are given in full. To protect other informants' identities, I have used substitute acronyms for their names, here as throughout the thesis.

List of interviews and other tapes

1/ Interview, discussion and meeting tapes

Tape Nos.	Name / Who / What
1	January <i>Espace Libre</i> concert and talks
2	January stage practical including practical sound eg's
3,4	George Newson: <i>stageaire</i> , composer
5	Guido Baggiani: <i>stageaire</i> , composer
6	HY: Dir. Music Research, composer (Int 1)
7	Anthony Brandt: <i>stageaire</i> , student (Int 1)
8	WOW: asst. Chant/Formes, jnr. tutor, composer (Int 1)
9	Claude Fatus: <i>Stageaire</i>
10	MU: <i>stageaire</i> , squatter

11 VT: *stageaire*, visitor
 12,13 Allain Gaussin: *stageaire*, composer
 14 WOW: asst. Chant/Formes etc (Int 2)
 15 Ivan Patatich: *stageaire*, composer
 15,18 Anthony Brandt: *stageaire* etc (Int 2)
 16,17 January stage psychoacoustics lecture by HM
 18,19 VT: *stageaire* etc (Int 2)
 19 January stage Formes lecture by JDK, WOW
 14,20 WOW: asst. Chant/Formes etc (Int 3)

21 HM: jnr. tutor, Pedagogy asst., psychoacoustician (Int 1)
 22 NI: visitor, small systems researcher
 23 NP: composer-squatter
 24 FA: Dir. Systems team (Int 1)
 25 NRD: consultant comp. scientist, visitor
 26 XR: secretary WV, Art. Dir., Programming
 27 KG: Administration, Dir. Personnel
 28 MC: Dir. Chant/Formes
 29 Discussion: Francois Bayle's commission including sound eg's
 (discussion - FB, RIG, HY, NP, WOW etc)
 29 Discussion: Alejandro Vinao's commission including sound eg's
 (discussion - AV, MC, WOW)

30,31 Alejandro Vinao: commissioned composer (Int 1)
 31,32 A.Vinao: commissioned composer (Int 2)
 33 Concert and introductory talk: Nigel Osborne,
 commissioned composer
 34 Nigel Osborne: commissioned composer (taped Int answers)
 35,36 FA: Dir. Systems team (Int 2)
 37 June stage Chant lecture by JDK
 38 HM: jnr. tutor etc, discussion of AV's production
 problems (Int 2)
 39 VR: Dir. Production Office
 40 XH: tutor (visiting), discussion of AV's prod. problems

41 WS: Administration, Accountant
 42,43 TY: Administrator, Dir. Administration
 43,44 JIG: tutor, composer
 45,46 JDK: tutor, comp. scientist (Int 1)
 47,48,49 FOK: Scientific Dir.
 49 June stage practical sound eg's
 50 WOW: asst. Chant/Formes etc (Int 4)

51 JDK: tutor etc (Int 2)
 52 George Benjamin: *stageaire*, composer
 52 WG: visiting comp. music researcher, composer
 53 NR: jnr. tutor, composer
 54,55 WOW: asst. Chant/Formes etc (Int 5)
 56 OF: technician, Sound team, 4X maintenance
 57,58 WV: Artistic Dir.
 59,60 HM: jnr. tutor etc (Int 3)

60,61 HM: jnr. tutor etc (Int 4)
 62 BL: Administration, Dir. *Regie Batiment*
 63 HY: Dir. Music Research etc (Int 2)

64	QRC: secretary VR, Production Office
65,66	RIG: Dir. Pedagogy, psychoacoustician (Int 1)
67	AJ: comp. scientist, Dir. 4X Signal Processing
68,69	YI: asst. Systems team, composer
70	VRn: technician, 4X Hardware
71,72	XW: researcher, Acoustics (Int 1)
72	XW: researcher etc (Int 2)
73	Sound examples made with Chant, from piece by BLr, commissioned composer
73,74	WUA: jnr. tutor, Chant/Formes
74,75	NU: asst. Systems team, 4X Software, comp. scientist
75	MI: Dir. Sound team
76,77	RIG: Dir. Pedagogy etc (Int 2)
77,78	RIG: Dir. Pedagogy etc (Int 3)
78	RIG: Dir. Pedagogy etc (Int 4)
79,80	HY: Dir. Music Research etc (Int 3)
81	VO: Dir. 4X Industrialisation
82	XU: Researcher, comp. scientist Chant/Formes
83	WF: Dir. Esp Pro team
84	LK: secretary/asst. RIG, Pedagogy
85	BYV: Dir. 4X Software, Boulez's tutor (Int 1)
87,88	HU: jnr. tutor, composer
88	ARY: technician/asst. Systems team (Int 1)
89,90	FLu: jnr. tutor, squatter, composer
90,91	BoW: new Dir. Systems team, composer
92,93	OR: secretary FOK, Sci. Dir., scientific sector
93	KR: Administration, mail man
94,95	BU: squatter, Prof. of comp. science
96,97	NF: Dir. Diffusion
97,98	ARY: technician/asst. Systems team (Int 2)
99,100	NGF: squatter, comp. scientist
100,101	WRY: asst. 4X Software, comp. scientist
101	WH: secretary HY, Music Research
102	JYC: tutor, composer (Int 1)

International Computer Music Conference, Oct. 1984:
live recordings of sessions, papers, discussions

103	MIDI panel discussion with Robert Moog, Gareth Loy, Katsuhiko Hirano, Bill Buxton, Boseto, George Lewis, E.Favreau
103,104	Affordable and Small Systems sessions, including papers by Dave Bristow (on Yamaha DX7), Kenneth Newby, Daniel Arfib, Dorothy Gross
104	Studio Reports IV: papers by Tristram Cary, Jiri Stehlik etc
105	Studio Reports IV contd; Signal Processing III: papers by Julius Smith, Gary Kendall, William Martens; Composition and Research III: Claude Cadoz paper
106	Composition and Research III contd: Phillippe Manoury, Xavier Rodet et al

Computer Music Association: meeting/discussion with Curtis Roads, Bill Buxton
 Demonstration: flute realtime control of 4X, Barry Vercoe etc
 107 4X/flute demo contd; Signal Processing IV: papers by Patrick Potacsek, M.Rozenberg, David Schwartz etc
 Composition and Research IV: papers by B.Mailliard and Y.Geslin, B.Mont-Reynaud and A.Schloss
 108 Composition and Research IV contd: W.Slawson, B.Truax, M.Stroppa, Gayle Young
 109 Composition and Research IV contd: Young contd, audience discussion, B.Buxton comments on Young paper, Conclusions

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110 Max Mathews: Dir. Bell Labs Acoustic Research Centre, former IRCAM Scientific Dir.
 111 KF: jnr. tutor, composer
 112 BU: Dir. 4X Hardware (Int 1)
 113 BU: Dir. 4X Hardware, demonstration of 4X sound eg's (Int 2)
 114 JYC: tutor, composer (Int 2)
 115 Sound examples: QG's 4X / flute realtime control project
 115,116 BUa: researcher / stageaire
 117,118 ICMC 'Off Festival': live concert recordings, intro talks
 118,119 ID: visiting comp. music researcher, comp. scientist, from UCSD CARL (Computer Audio Research Lab)

Tapes from later IRCAM visits and related events

120 WI: visiting Yamaha small systems researcher
 121 VN: new (1985 on) IRCAM Administrator
 122 BYV: Dir. 4X Software etc (Int 2)
 123 WOW: asst. Chant/Formes etc (Int 6)
 124,125 WLe: ex-IRCAM co-Director, pre-1980 (interviewed at home)
 126,127 JPO/HG: two officials from *Direction de la Musique*
 128 Debate on IRCAM: 1985 Huddersfield Contemporary Music Festival
 129 Interview with Luciano Berio, ex-IRCAM co-Director, pre-1980, Huddersfield 1985 (including discussion of IRCAM)

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Music and music example tapes

M1 Alejandro Vinao: 'Hendrix Haze' (non IRCAM piece, studio rec)
 M2 Live recording of IRCAM commission premiere by George Lewis, 'Rainbow Family', Esp Pro 24.5.84
 M3 Live recording of IRCAM concert with pieces by Marc Battier, Horracio Vaggione, Alejandro Vinao, Esp Pro 12.6.84
 M4 A Karlheinz Stockhausen: 'Michaels Reise Um Die Erde', live recording 25.10.78
 M4 B Pierre Boulez: 'Repons' London version, live recording 6.9.82
 M5 Phillippe Manoury: 'Zeitlauf', live recording IRCAM 16.2.83
 M6 Jonathan Harvey: 'Bhakti', live recording IRCAM 6.12.82
 M7 York Holler: 'Arcus', live recording IRCAM 23.6.84
 M8 Compilation: major IRCAM pieces / commissions
 A 1/ Jonathan Harvey: 'Mortuous Plango, Vivos Voco'

2/ Jean-Claude Risst: 'Songes'
3/ Tod Machover: 'Soft Morning, City'
B 1/ Jean-Baptiste Barriere: 'Chreode I'
2/ Kaija Saariaho: 'Verblendungen'
M9 A Clarence Barlow: 'Im Januar Am Nil', live recording Grande
Salle, CGP 18.5.84
B Clarence Barlow: 'Cogluotobusisletmesi', live recording Lille
Festival 30.11.80

Appendix 2 IRCAM's administrative and management structure

In this Appendix I outline IRCAM's external and internal administrative structures. IRCAM is self-consciously bureaucratic and has its own specialised administration. In many ways it appears to conform to the norm for a French public institution, with all the bureaucratic apparatus that implies. However, IRCAM is in fact a curious hybrid, part public, part private, which is reflected in an unusually autonomous constitution.

The external administration

From its founding until the end of 1976, IRCAM was a public institution and a department of the CGP. In January 1977, the institute changed its constitution and became a semi-autonomous private association, retaining certain important links with the CGP - "*un organisme associé au Centre*". It still remains, with the National Museum of Modern Art, the Public Information Library, and the Centre for Industrial Design, one of the four bodies making up the CGP. However, unlike those other bodies IRCAM has an autonomous statute, deriving from a 1901 law, as an 'association recognised to be of public benefit'. This institutional autonomy, which accords with Boulez's original plans (see Ch.2.3.4), reflects IRCAM's exceptional status and higher privilege compared with similar institutions, including the other parts of the CGP. This is partly due to IRCAM's international scope; but also because the institute is involved in both reproduction (performance, education) and also in the production of research, technology and music, by contrast with the CGP, and other museums and music venues which are confined to reproduction. In this sense, cultural production and reproduction are often conceived as an opposition in which the terms have unequal status, and in which, of the two, production carries the higher cultural status.

The 1977 statutes of IRCAM state that it has three aims. First, to conduct fundamental and applied research related to questions of musical creation, notably by establishing research teams composed at the same time of artists, scientists and technicians. Second, to study the possibilities offered to composers and performers by recent scientific techniques in the production of new sounds. Third, to communicate, distribute and make public the results of these research activities. The statutes continue that IRCAM should make all necessary contacts to sustain international co-operation and to participate internationally in these fields. Also, IRCAM is obliged to continue its close relations with the CGP, by bringing its work to bear on the cultural policies and activities of the CGP.

IRCAM became a private association for several reasons: first, to be able easily to employ foreigners, since that was difficult as a public institution. Also, to be less top-heavy, more independent administratively, and more financially flexible. Previously all financial decisions had to go through first the CGP and then the Ministry's Direction of Music for ratification. Finally, Boulez wanted to be able to receive private patronage in addition to public funding, impossible as a public institution; and he wanted in particular to foster the relationship with Paul Sacher - a millionaire Swiss

benefactor, and Boulez's friend, with a long history of supporting contemporary music. By becoming a private association, IRCAM could benefit from Sacher's patronage; and in return Sacher could sit on the IRCAM Administration Council, which would be impossible for a foreigner to do in relation to a public institution.

In support of IRCAM's secession, the IRCAM Administrator stressed the obvious big differences between IRCAM and the CGP. IRCAM does research, whereas the CGP does none. IRCAM has many foreign workers, while the CGP has almost none. IRCAM is not generally open to the public, while the CGP has around 25,000 visitors a day. Finally, unlike all the other CGP departments, IRCAM is physically independent of the main CGP building.

IRCAM's independence was granted on condition of retaining major ties to the CGP. Notably, the President of the CGP remains IRCAM's honorary President, while in return Boulez sits on the CGP's ruling executive. But also, IRCAM's salary and employment structure have to remain congruent with the CGP's public sector pay scale and employment policy. Above all, IRCAM's main Ministry of Culture subsidy continues to come through the CGP as intermediary; and yearly budgeting decisions are still discussed at the CGP with the President. It seems, then, that links with the CGP remain strong. However, when IRCAM separated it became subject to a different sector of French law from the CGP, since there are two entirely separate realms of public and private law. The IRCAM Administrator said that her time was much consumed by interpreting, and accounting to, this private law.

The result of the complicated history of relations between IRCAM and the CGP, of IRCAM as a public and then private institution with continuing links to a parent public body, is some ambiguity of legal status. This seems useful and manipulable by those in power when they see it as politically desirable. Thus, we will see that in negotiations for industrialising the 4X, it was not clear whether IRCAM could or could not develop a commercial offshoot - 'IRCAM Enterprises' - to manufacture the machine (see Ch.2.1.5).

Since the 1977 change, IRCAM's external administrative structure consists of two main bodies: the Administration Council, and the General Assembly. The Council is the active executive. It meets twice a year to survey the overall progress and direction of the institute including plans for the coming year, reports of what has been achieved, and budgets; even the redeployment of posts has to be agreed. Sitting on the Council are representatives of all IRCAM's major funding bodies: the President of the CGP (Jean Maheu), still also IRCAM's President; the Director of Music, head of the Direction of Music at the Ministry of Culture; a delegate from the Ministry of Research (formerly the *Direction Generale de la Recherche Scientifique et Technique* (DGRST)) - another fund-giving body; the President of the Council of the CNRS; and 10 further elected representatives: 3 from the Ministry of Culture and CGP, and up to seven members from the Assembly. Council membership is honorary and members receive no financial reward for their services.

The Assembly is made up of all members of the IRCAM Association, including private patrons or benefactors, who must be agreed by the Council. Members pay an annual subscription, and benefactors deposit

additional sums. In addition there is a consultative scientific body, the Scientific Council, consisting of 10 to 20 French and foreign scientists, who are appointed by the Administration Council. This body was created to balance with scientific expertise the artistic expertise embodied in the other executives, and most notably in Boulez. However, the Assembly and Scientific Council do not meet regularly and did not meet during 1984.

Overall executive responsibility for the institute is vested in the Director, appointed by the Administration Council, who must report back and account to them. Since IRCAM's beginnings the Director has remained Boulez.

The internal administration

Boulez also has overall internal management responsibility, and for this he has a Direction department with two assistants. For basic administration, however, there is an IRCAM Administration department headed by the Administrator TY. Boulez and TY divide up general management, but Boulez is senior and responsible to the Council. TY appears to be officially second in command to Boulez's overall direction, but we will see in Ch.4 that the division of labour is unclear. The original Administrator, BD, who set up IRCAM with Boulez, was a friend of Boulez's; they had met through both being involved in plans to reform the Paris Opera. BD was a very high up official; and he left IRCAM in 1982 to become a French Judge at the European Court of Human Rights. By contrast TY, who took over in 1982, was a professional state administrator and had worked as BD's assistant; she was not haute bourgeois and not involved in high cultural affairs. This switch from an appointment based on personal and high cultural ties to a lower status, specialised and 'rationally bureaucratic' one appears to have created tensions within IRCAM as I show in Ch.4.

IRCAM's British Artistic Director depicted IRCAM's early privileged existence as closely linked to the status of the original Administrator BD, who he described as socially exalted: "He's a very upper class *fonctionnaire*, I mean really high class.. *Conseil d'Etat* and all that... Boulez wanted him because he'd done all the statutes, all the paperwork, for the big Opera scheme.. they were going to take over the Opera. That's how he knew BD... (BD) was the Secretary General of a big company run by Claude Cheysson, who's now Foreign Minister". Talking of the way IRCAM and the EIC had been set up with the direct patronage of figures at the highest levels of state, he joked ironically, contrasting French politics with those of the British Arts Council as follows: "Well, they were with us from the start! If you're not friendly with Louis the Fourteenth, then you won't be able to sing at Court! France is a monarchy, you see; whereas the British behave in a Republican-Democratic fashion! (laughs)".

IRCAM's Administration department has two domains. It does all the basic preparation and paperwork for liaison with IRCAM's external administrative structure, including the bodies on which IRCAM depends for support - particularly the CGP and Ministry of Culture. The Administration also manages internal administrative affairs such as personnel, finance and accounting, and running the buildings. For this,

TY has around 10 workers, including an accountant, a personnel officer, a building caretaker and their subordinates. The department prepares annual budgets and organises the round of internal budget arbitration between departments. It negotiates and supervises appointments, salaries, promotions, conditions of work, and prepares contracts. Salaries and employment status are formally organised according to public sector guidelines and their hierarchical scales. The personnel officer also organises the '*Comite d'Entreprise*' - the institute's in-house workers' consultation body, which French businesses often have in lieu of union representation. The department runs the security pass system, and looks after the maintenance and development of the building including day to day liaison with the CGP on joint matters such as the shared air conditioning system and cleaners.

In proper bureaucratic fashion, the Administrator issues a formal diagram of the organisation and power structure of the institute called an '*organigramme*'. Three are shown in Illustrations 2.1, 2.2 and 2.3 dated 1982, mid 1983 and 1985. They illustrate the nature of the *organigrammes* and changes between them: the evolution of the formal model of IRCAM. The earlier diagrams indicate 'functional' and 'hierarchical' relations between parts of the institute, and all show the constituents of each department, committee and position. One can see two major changes in the evolution: from 1982 to '83 the '*Comite Mixte*' is scrapped and its co-ordinating position taken by the newly promoted Production Office; and from '83 to '85, significantly following the arrival of a new Administrator late in '84, the Administration becomes higher in the power structure. From an appendage, it moves to just below Boulez in the chain of command: clearly a bid for more power and authority. Boulez's consent to the structure is often signified visibly and personally by his signature (as on the 1985 diagram); but the diagrams have no contractual status. They are however, with the internal phone lists, the only public and visible guide to roles and status within the institute. The diagrams are a way in which the Administrator, having gained Boulez's backing, can attempt to influence the formal organisational and power structure. Further signs of IRCAM's bureaucracy include the institute's formal paperwork, the many memos between departments, and the general stress on documentation.

The Administration department is part of IRCAM's daily work culture, but within this it has an anomalous position. The department is largely separate from the rest of the institute, both physically and socially. It is located separately, in the old building; and it is the only department with a completely autonomous micro computer network, used for personnel, salary and other financial matters, which is not linked to the network joining up the rest of the Institute's computers. I was told that this was necessary for security reasons, which indicates a lack of trust from the Administration towards the rest of the house. It also raises the general issue of security for information stored on computer, which I discuss in Ch.8. The distrust was reflected back, since workers from all levels of the rest of the institute expressed distrust and dislike for the Administration (see Ch.4). Lower clerical and technical staff see them as a police force, uncooperative and mean about negotiations over salaries and conditions; and intrusive, even vindictive, in their use of power over lower status workers. Amongst higher research and production staff, those views are overlain with

disdain for the Administration, who are seen as philistine *petit bourgeois* managers, unable to appreciate IRCAM's higher artistic and scientific concerns.

There are also two executive bodies within IRCAM: the Scientific Committee, and the Artistic Committee. Formally, according to the *organigramme*, each supervises the relevant sector within the Institute. The two committees appear to carry equal authority, and to be composed of Boulez and the directors of departments within that sector. But actually they have different power and functions, and are run differently. The Artistic Committee is the most powerful decision-making body in the institute. Its meetings are regular, and are closed. The real politics of the institute take place in this Committee: invitations to composers and researchers, commissions, musical and conference events, long term planning, and public relations - everything except pure scientific and technological issues, although even some technological policy is hammered out there. By contrast the Scientific Committee is a more like discussion forum for reviewing developments, and has little real policy-making power. It meets less regularly - indeed in '84 these meetings were often cancelled at short notice because of clashes with other meetings outside IRCAM on the 4X industrialisation deal (see Ch.2.1.5). All those working on the scientific side, and anyone interested, can attend the Scientific Committee meetings, which are a mixture of research seminars, general discussion and political sounding-off sessions. A researcher called them cynically "just a therapy session" to me.

There is also a formal executive position of Scientific Director of IRCAM, who is supposed to manage the scientific sector for Boulez since he is not qualified on that side. The *organigramme* shows the Scientific Director as responsible for the scientific side, while Boulez is overall Director subsuming both scientific and artistic sides. However, the Scientific Director is an anomalous and difficult role to hold, and they have come and gone during IRCAM's history, lasting usually around a year. Their authority and power are unclear and contested, yet they carry the can for the many technical problems that arise. All of this indicates how the authority and power of the scientific side of IRCAM is relatively less than, and encompassed by, the artistic side: in fact, the arrangement implied by the IRCAM statutes, in which science and technology are seen ultimately as serving musical ends.

Despite the apparent bureaucratic order, I have hinted that IRCAM is an uneasy bureaucracy. I show in Ch.4 that IRCAM's actual functioning not only fails to live up to its bureaucratic surface, but that countervailing forces within the institute undermine and counter that power structure.

Appendix 3 IRCAM's income, expenditure and infrastructural outlay

In this Appendix, I give fuller information on IRCAM's economics: its income, expenditure and budgets negotiations, and infrastructural costs.

Income

Table Ap3.1 is a breakdown of IRCAM's predicted subsidies for 1984 showing the proportion of the total predicted income of 30.5 million fr. that is expected to come from each source. (This information was given orally and fast, and so is approximate). The Ministry of Culture is expected to provide 69%, the vast majority of the total; the Ministry of Research 3.3%, and the Sacher foundation 1.3%. The remaining 26.4% is to come from IRCAM's own resources, of which 9% is interest on bank reserves, and 13.8% money held back from the previous year's funds. Earned income makes up only 3.7% of the total, so that sales do not provide substantial input at all.

Table Ap3.2 shows IRCAM's total annual incomes between 1978 and 1984. As we see in Appendix 4, the most notable change comes between 1981 and 1982 with a sudden jump in subsidy from c.19 million to c.28 million francs. This was due to the Socialist government's accession to power in April 1981, after which they almost doubled IRCAM's subsidy in line with their general cultural and educational policy. However, by 1984 the reigns were being pulled in, and the Administration were looking for savings of c.4%-5% during that year because of a drop in the rate of increase of the subsidy from central government. Since then, the subsidy has stayed about the same, meaning a drop in income in real terms. By 1987, the IRCAM Administration were beginning to articulate the need for IRCAM to be more self-financing (IRCAM publicity document 1987:12). All of this indicates a change of climate, both within the country as a whole under Socialist policies, and in relation to IRCAM. But as I also show in Ch.2 (and Appendix 4), officials still took the attitude in 1987 that IRCAM would remain securely financed without the need to seek other sources and, importantly, without the need to re-direct its technology or research programmes to make them more commercially viable.

Expenditure

Table Ap3.3 illustrates how a yearly budget is divided up through a breakdown of the expected expenditure for 1984. It shows that permanent salaries take about 45%, research and production running costs (in both the scientific and music production sides of the institute) 37%, and infrastructural investment in equipment and materials 12% of the total yearly budgets. Thus personnel are by far the largest cost. If we compare the outlay on music projects with that on science / technology projects, it appears that music does better: (music gets c.5,700 MF while science/technology gets c.3,600 MF). However much of the equipment budget of 3,500 MF goes towards technology that, although of use for music production too, is primarily used for technology projects such as software development. This therefore balances out the discrepancies. The outlay on personnel however reveals an unexpected bias towards technology staff as against music staff. I show in Chs.2 and 3 that if we break down the 54 permanent posts, they are

Table Ap3.1 IRCAM's predicted main sources of income for 1984

The Ministry of Culture:	
For personnel -	15,216 MF
For material -	2,635 MF
For activities -	300 MF
For research -	2,884 MF
TOTAL:	21,035 MF (69%)
The Ministry of Research (formerly the DGRST):	
For equipment -	c.1,000 MF (3.3%)
IRCAM's investments - bank interest accrued:	
	2,748 MF (9%)
(This figure implies that, at c.10% interest, IRCAM's bank reserves are substantial: some 27 million francs)	
IRCAM's reserves - money left over from the previous year's budget:	
	c.4,200 MF (13.8%)
IRCAM's sales - fees, tickets, subscriptions, goods:	
	c.1,140 MF (3.7%)
Private donations and patronage - here from the Sacher foundation, the major source:	
	c.400 MF (1.3%)
<u>TOTAL INCOME</u> - c.30,523 MF, or 30.5 million francs	

NB: figures are approximated in thousands of francs, MF
Source: oral account by Administration informant, hence discrepancies with Tables Ap3.3 and Ap3.4

Table Ap3.2 IRCAM's total yearly income 1978-84

1978	1979	1980	1981	1982	1983	1984
13,150	14,825	16,810	18,890	28,305	26,646	28,982 (or 30,682)

NB: figures are in thousands of francs, MF
Source: Le Monde de la Musique Nov. 1981 plus additional information

Table Ap3.3 Breakdown of IRCAM's expected 1984 expenditure

A. The operations budget: this is in 4 main parts, as follows:

1/ Personnel: ie salaries for the 56 posts - which came in 1984 to
Total - 13,146 MF or 45% of the total budget;

2/ Operating services: this includes the running costs of all research and production related parts of the Institute, and breaks down as follows:

- Research (scientific, technology projects)	3,612 MF (12.4%)
- Musical Creation (music production projects)	5,682 MF (19.6%)
including Music Research	361 MF
Pedagogy (ICMC)	1,141 MF
Production (concerts, commissions)	3,146 MF
Diffusion, external relations	1,034 MF

- Communal services (for both scientific and musical projects)	1,556 MF (5.3%)
including Direction	37 MF
Library	124 MF
Esp Pro team	473 MF
Sound team	922 MF
Total -	10,850 MF or 37.3% of the total budget;

3/ Functional services: ie departments running the Institute overall:

- Administration	888 MF
- Building Maintenance	197 MF
Total -	1,085 MF or 3.7% of the total budget;

4/ Credits to share out: (?)

- Personnel	130 MF
- Materials	271 MF
Total -	401 MF or 2% of the total budget.

B. The equipment budget: this concerns only investment in materials.

I was given two figures for this in 1984. Officially the...

Total - 3,500 MF or 12% of the total budget;

But initially I was told that an additional 1,700 MF had been found to buy new digital tape recording equipment, which would make the...

Total - 5,200 MF ..hence the two different total budgets in Tables 6.2 and 6.4.

NB: figures are in thousands of francs, MF

Source: Presentation of IRCAM's 1984 Budget: document prepared for Administration Council, Nov. 1983

predominantly reserved for administrative, clerical, technical and science staff plus odd directors. There are very few permanent music staff, and almost none are employed in the capacity of composers; musicians tend instead to have temporary, contractual relationships with IRCAM.

This 1984 expenditure estimate also shows the budget categories. Budgets are divided into 2 main parts: an overall operations budget, and a new equipment and investment budget. The first part, by far the largest at 88%, is co-ordinated by the Administrator TY; and the second part, just 12%, is co-ordinated and controlled by the 4X Industrialisation director VO. Control of budgets is a major form of power within IRCAM, and a focus of conflict. The story goes that VO fought for control with the new Scientific Director FOK, and VO won out since he has long standing good relations with the Administration. It was said that FOK, new to IRCAM and so ignorant of the Administration's procedures, had been tripped up by preparing his budget late without being warned. So VO retained control of this budget from FOK, nominally his superior manager. The story again illustrates the anomalous position of the Scientific Director.

Table Ap3.4 shows the breakdown of each annual budget, where known, for the years 1978 to 1984. Salaries remain the major proportion of outlay. Other parts of expenditure remain fairly constant percentages; although the 'functional services' (Administration) budget has stayed around the same amount over 7 years, representing a substantial real drop. The most striking budget change comes in 1982, the year of the enormous rise, in which outlay on equipment suddenly leaps from almost nothing to 6.2 million francs. This was caused by IRCAM's acquisition of the new VAX mini computer, in turn caused by the previous mini, a PDP10, becoming inadequate for IRCAM's needs and having soaring service charges: a phenomenon that I discuss below.

Infrastructure

The original infrastructural outlay on IRCAM's new underground building was 59.2 million francs (in 1973 terms). This included the specialised *Espace de Projection* performance space with its complex system of acoustic panels, other built-in research facilities, and the original equipment for the computer department and the recording studios. The major infrastructural problem for IRCAM is the extremely rapid obsolescence of its computer and other technical equipment, necessitating not just renewal and replacement, but continuous upgrading too. The PDP10 minicomputer, bought in 1975, lasted just 8 years with constant additions; and within a year of the new VAX operating, there were calls for a second one to ease congestion on the system. In 1984 alone, there were constant purchases of new hardware and software to strengthen and enlarge the system. The other major infrastructural cost for IRCAM is in regular maintenance or servicing of its complex technologies, especially those bought rather than made at IRCAM. Usually, IRCAM is dependent on the supplying company to service their machines; so there is no control over the rapidly rising service charges, which supplying companies use as means of forcing the customer eventually to throw out the extant technology (even if still functional) and upgrade. Maintenance on all computer hardware related technologies,

Table Ap3.4 Breakdown of IRCAM's annual expenditure 1978-84

	1978	1979	1980	1981	1982	1983	1984
I) Operations -							
1/ Personnel - (56 posts)	6,464	7,210	8,054	9,086	10,464	??	13,146
2/ Operating Services -	4,389	4,865	5,790	6,077	8,812	??	10,850
[incl concerts, external rels -	1,669	1,975	2,241	2,831	3,455	??	??]
3/ Functional Services -	1,071	1,571	0,775	0,925	1,136	??	1,085
4/ Stock - (incl equipmt renewal)	1,226	1,149	1,391	1,502	1,693	??	0,401
II) Equipment - (new acquisitions, investments)	00	0,003	0,800	0,700	6,200	??	3,500 (+1,700)
TOTAL	13,150	14,825	16,810	18,890	28,305	26,646	28,982 (30,682)

NB: figures are in thousands of francs, MF

Source: Le Monde de la Musique Nov. 1981 plus additional information

for example, cost IRCAM about 6-700,000 francs a year in 1983 and 1984, of which the American Digital Equipment Corporation (DEC) alone took some 510,000 francs in 1983.

IRCAM has to pay in order to buy most of its hardware, which is mainly American technology. (Both the PDP10 and the VAX were made by DEC). This causes particular problems because major foreign purchases require an enormous amount of bureaucratic paperwork, even for IRCAM. However, the institute gets round these problems due to the personal contacts and skills of the director of the Pedagogy department, the American RIG, who makes extraordinary deals with American and Japanese companies and managed to get round many of the obstacles to buying the VAX. RIG negotiates educational / research status licences as opposed to commercial licences for IRCAM, which means that it generally gets discounts on technologies, and receives software nearly free as part of the international research community rather than having to pay high commercial fees. This licence status is not as straightforward as it seems, since it is normally dependent on an institution granting some kind of educational diploma, whereas IRCAM does no such thing. RIG was nonetheless able to negotiate around this problem and gain the status for IRCAM.

In addition, RIG manages periodically to get free technology for IRCAM, especially small, personal computer systems. During 1984, he made a deal with the American Apple corporation for them to supply IRCAM with several Macintosh personal computers: they were the first to arrive in France. He also arranged for Yamaha to provide IRCAM with several of their recent sophisticated small digital synthesisers: the new DX range. Other directors are also involved in making deals, notably 4X Industrialisation director VO; but RIG is the most successful. This illustrates a central issue in relation to IRCAM's internationalism which I discuss in Chs.2 and 8: its profound technological dependence not only upon American computing technologies, but also on its American personnel for their networks and contacts concerning the technologies, and for their skills and knowledge.

Appendix 4 Summary of IRCAM population 1984

As mentioned in the text, by department, position, or other relation to IRCAM. Substitute acronyms used for most subjects' names.
For 1984 except where stated otherwise.

<u>Dept./Relation</u>	<u>Name</u>	<u>Position/Role</u>	<u>Contract*</u>
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Past IRCAM Co-Directors, pre-1980 reorganisation

Instruments and Voice	BA	Director	[P FT?]
Electro-Acoustic	L.Berio	Director	[P FT?]
Computer	JC.Risset	Director	[P FT?]
Pedagogy	YRe	Director	[P FT?]
Diagonal	WLe	Director	[P FT?]
Scientific Sector	M.Mathews	(past Sci. Director)	[P FT?]
Administration	BD	Past Administrator	[P FT?]

DIRECTION	P.Boulez	Director of IRCAM	P FT?
	SA	Secretary PB/Direction	P FT
	CS	Secretary (& Diffusion)	P FT

SCIENTIFIC SECTOR

Scientific Director	FOK	Scientific Director	P FT
Scientific Committee -	PB	Director	
	FOK	President of SC, Scientific Dir.	

plus all directors, researchers, technicians from ScS projects

Scientific Sector Secretaries

OR	Sec to JPK (SciDir), AF(Systems grp)	P FT
ERO	Sec to JPA, PDG, TAG (4X), Acoustics	P FT

The 4X related projects

4X Hardware	BU	Director	P FT
	VRn	Technician	P FT
	VK	Technician	V FT
	OF	Maintenance tech. (& Sound)	P FT
4X Dig. Signal Proc.	AJ	Director, programmer	P FT
4X Software	BYV	Director	P FT
	BX	Programmer (& Exp. System)	P FT
	NU	Programmer (& Systems team)	P FT
	UK	Programmer	V FT
	WRY	Programmer	V FT
	(FO	past Director)	[P FT]

4X Industrialisation, Equipment and Material Investments

VO	Director	P FT
XK	Technician	P FT

QG's 4X Soft project	QG	Director	Vis (H)
	XC	Researcher	V FT
	WaQ	Researcher	V FT

Man-machine Interface, Computer Hard, Labs Management and Maintenance

MIO	Director (until mid '84)	P FT
ZR	Technician	V FT
NRt	Researcher	V FT

Non 4X projects

Chant/Formes project	MC	Director	V PT (1/2)
	XU	Programmer	P FT
	WOW	Assistant (& Pedagogy)	(V FT)
	WO	Stageaire/ MC's postgrad	St
	NG	Stageaire/ MC's postgrad	St

Expert System	FOK	Dir.(& Sci. Director)	(P FT)
	BX	(& 4X Soft)	(P FT)
	HM	(& Pedagogy, Psychoacs)	(V FT)

FPS/Array Processor	JDK	Dir.(& Pedagogy/Tutors)	P FT
	QO	Programmer (& Pedagogy)	V FT

Acoustics, Instrumental Research Workshop (ARI)

ARI	EO	Director	V PT (1/2day/wk)
	XW	Engineer, researcher	P FT
	MR	(past Director)	
	HH	Researcher	V PT (1/2)
	VUT	Dir./Researcher	V PT (1/2)
	FI	Researcher	V PT (1/4)

Mechanics Workshop	YR	Mechanical tech.	P FT
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Computer systems team	FA	Director (until mid '84)	P FT
	BoW	(new Director from mid '84)	P FT
	ARY	Assistant	P FT
	YI	Assistant	V FT
	NU	Ass. Programmer (& 4X Soft)	(P FT)

Visiting consultant computer scientists

BWr	Graphics programmer	H
NRD	UNIX/VAX programmer	H
NM	UNIX/VAX programmer	H

MUSIC PRODUCTION SECTOR

Artistic Committee: Restricted - PB Director

WV President of AC, Artistic Dir.

plus all directors of MPS depts and Prod. Office: NF, RIG, HY, VR;

Full AC - as above plus tutors: WR, JDK, JIG, JYC/XH, and BYV, WOW

Programming	WV	Artistic Director	P FT
	XR	Secretary	V FT

Diffusion: External Relations, Publicity, Press

NF	Director (& video team)	P FT
BL	Assistant	P FT
HK	Secretary (& video team)	P FT
CS	Assistant: Press (& Direction)	P FT

Pedagogy: Stage, Library, Tutors, Psychoacoustics, ICMC			
	RIG	Director	P FT
	LK	Assistant	P FT
Library	OW	Librarian (until BF's arrival)	St
	BF	Librarian	P FT
Tutors	WR	Tutor	P FT
	JDK	Tutor	(P FT)
	JIG	Tutor	P FT
	JYC	Tutor (on sabbatical)	P FT
	XH	Tutor (substitute for JYC)	V FT
Public lecturers	HU	Lecturer (& EIC)	V PT (1/2)
	DJ	Lecturer	V PT
	RP	Lecturer	V PT
(Psychoacoustics)	HM	Psychoacs, jnr tutor (& Exp System)	V FT
Unofficial / junior tutors	WOW	Junior tutor (& Chant/Formes)	V FT
	NR	Junior tutor	V FT
	WUA	Junior tutor	V FT
	KF	Junior tutor	V FT
	QO	Junior tutor to be (& FPS)	(V FT)
	FLu	Junior tutor to be	Sq
Stageaires/postgrads	JZ		St
	BUa		St
ICMC organisation	AN	Assistant to DLW	V FT
	FrA	Secretary	V FT
Music Research	HY	Director	P FT
	WH	Secretary	P FT
PL's Project	PL	Composer, programmer	V/Comm FT
Production Office	VR	Director	P FT
	QRC	Secretary	P FT
Espace de Projection Team	WF	Director (& video team)	P FT
	VOG	Technician, lights (& video)	P FT
	HI	Stage manager (& video team)	P FT
Sound Team	MI	Director	P FT
	EF	Sound technician	P FT
	VI	Sound technician	P FT
	BW	Technician	P FT
	OF	Audio/studio maintenance (& 4X Hard)	P FT
Administration	TY	Administrator/Dir Admin, Finance	P FT
	KG	Personnel chief	P FT
	WS	Accountant, budgets	P FT
	DY	Secretary	P FT
	KX	Accounts secretary	P FT
Regie Batiment: caretakers, building management			
	BL	Director (& video team)	P FT
	BA	Technician (& video team)	P FT
	JFA	Odd-job man ('polyvalent')	P FT
	KR	Postman, messenger	P FT
	BR	Secretary Regie Bat, EspPro, Sound	P FT
	WX	Hostess	P PT (1/2)

VISITORS, OCCASIONALLY EMPLOYED

Squatters, occasionally employed: often around

NGF	Programmer, researcher (future P FT)	Sq
BU	Prof of Comp. Science	Sq
FQ	Musicologist	Sq
NP	Composer (& assoc Chant/Formes)	Sq
FLu	Composer (& jnr tutor to be) (Sq)	
BH	Composer	Sq
MU	Stageaire/composer	Sq

Officially IRCAM commissioned composers: working or visiting often

Long stay during '84	A.Vinao	Composer	H/Comm FT
	BLr	Composer	H/Comm FT
	FG	Composer	H/Comm FT
	QG	Composer (& QG's 4X Soft proj)	(Vis (H))
	PL	Comp, programmer (& PL's Proj)	(V/Comm FT)
Short visit	K.Stockhausen	Composer	Vis (Comm)
	B.Anderson	Comp, asst. H.Birtwistle	Vis (Comm)
	F.Bayle	Composer	Vis (Comm)
	N.Osborne	Composer	Vis (Comm)
	J.Harvey	Composer (past, future Comm)	Vis

IRCAM-related composers: friends, past or future commissions, occasional visitors

CX	Composer (ex IRCAM tutor)	Vis
C.Barlow	Composer (past Comm)	Vis
G.Benjamin	Stageaire/composer (future Comm)	Vis
R.Boesch	Composer	Vis
H.Dufourt	Composer (future Comm)	Vis
T.Murail	Composer (past Comm)	Vis

Computer scientist, programmer, and computer music research visitors

ID	Comp. mus. researcher (UCSD CARL)	Vis
WG	Comp. mus. res, composer (Toronto)	Vis
M.Mathews	Past Sci Dir (Bell Labs)	Vis
JC.Risset	Past Computer Dept Dir (past Comm)	Vis

Miscellaneous unofficial visitors

NI	Small systems res, comp, (ex-Bell Labs)	Vis
VT	Stageaire, small systems	Vis
IQ	Musician	Vis

* Key to contracts or relation to IRCAM

P - 'Poste' or permanent contract (*contrat duree indeterminée*)
V - 'Vacation' or temporary contract (*contrat duree determinee*)
H - 'Honoraire' or fixed length consultative or task-specific contract
FT - Full time
PT - Part time, (1/2) - half time etc
St - 'Stageaire' or graduate student
Sq - 'Squatter', unofficial visitor or worker, or occasionally employed
Comm - Commissioned composer - in process, past or future
Vis - Visiting for short period without contract
() - Not main job, additional work
[] - Not working at IRCAM during '84: past worker

Appendix 5 IRCAM's conditions of existence (1): The national context

Introduction

This Appendix shows how the origins and character of IRCAM can be accounted for, in the first place, as a result of aspects of French national culture and cultural politics. I discuss the way that the institute expresses four major tendencies within contemporary cultural production outlined (after Williams 1981) in Ch.1: the growth of highly privileged cultural institutions; the expansion of cultural bureaucracy; the increased scale of cultural production; and the increased tendency towards internationalisation and international cultural flows. I add two further implied tendencies, which are especially relevant to IRCAM and to French culture: increased centralisation and rationalisation.

Beginning with French cultural politics, I discuss the role of high technology in French national culture in general, the changing nature of cultural policy, the role and character of French intellectuals, artistic and cultural rivalry between France and the United States, and the particular French origins of the concept of the avant garde. In the second half of the Appendix, I look at developments and controversies within French contemporary music culture and policy; and I end by outlining the attitudes of current officials at the *Direction de la Musique* towards IRCAM, its role and legitimation.

I make the following points. I discuss, first, how French cultural policy has favoured the growth of centralised, bureaucratised, highly privileged cultural institutions. Then I discuss the way that French intellectuals have, historically, taken a high profile both publically and in policy terms, and their changing relations with the political Left; so that what I later describe as characteristic of Boulez's personal history - his polemics and political interventions, the politicised flavour of his rhetoric, and his bids for national and international prestige - become more understandable. I show then how the nationalist intent of French cultural policy follows not only periods of internal social crisis, but is also linked to important international rivalries, and particularly that between France and the USA - a rivalry embedded in major shifts in international cultural leadership over the last 50 years. This introduces a tension between nationalism and internationalism that I argue is characteristic of the avant garde, and that we will see within IRCAM. I then trace the French origins of the concept of the avant garde, which derives from early French socialist thought, in which we find the notion that art should take a leading political role, and that it should be closely allied to science: another association characteristic of IRCAM. National policy on contemporary music has seen changes related to much of the above: from the support of individual composers through commissions for pieces, the state has increasingly channelled funds through a new kind of institution for contemporary music, and especially through those bringing technology and science together with music, of which IRCAM is by far the largest example.

In Appendix 6, I examine the relation of Boulez's personal history to these tendencies; and his agency in bringing about their exemplification in the institution of IRCAM. This leads to a consideration of Boulez's

original conception of IRCAM.

I begin here by sketching certain broad aspects of national culture and political economy, to do with the increasing centrality of new technology, its interrelation with France's strong nuclear programme, the state's commitment to high technology research and development; and, finally, the changing political climate towards technology. This provides a background against which to understand the importance, and the character, of IRCAM's involvement in high technology research and development.

Aspects of French culture and cultural politics

Technology, nationalism, and changes in French politics since 1968

Since De Gaulle's accession to power in 1959, the French economy and state have been characterised by an aggressive technological nationalism, both civil-industrial and military. De Gaulle instigated a modernisation programme designed to recreate France as a leading world power, centred on three interrelated goals: military independence, economic independence, and technological leadership, without which the previous two were unattainable. As McDougall (1985) puts it, De Gaulle "launched a revolution from above to reify his 'certainne idee' of a Technocratic France, the R and D state... The constitution of the Fifth Republic enhanced the power of the executive,... reformed the universities, folded small industrial concerns into mighty semipublic corporations, and linked them to state agencies in a coordinated national team for the force-feeding of technological change, with the state itself as managerial czar" (1985:182-3). Behind this were deeper nationalist aims: above all, the desire to throw off military, economic and technological dependence upon the USA within which France had been enmeshed since the War; but also, behind the military developments, attitudes towards the threat from the Soviet Union and nationalist rivalries towards the rest of Europe, and notably Germany. De Gaulle's plans thus centred upon the development of an independent defence system based upon a French nuclear weapon, the '*Force de Frappe*'. By the late 1960's the state-led technology push had generated the highly successful and interrelated growth of the defence industry and the civil nuclear power programme. Both have continued to be extremely important to French economic development; and both, especially the mixed state and private defence industry, are deeply implicated in the development since the 1960's of a mass of spin-off, state centralised, high technology R and D programmes.

During the 1970's, the centre right governments continued to give the highest priority to technology-led economic development, with more attention to creating mass, national consumer markets for French information technology (eg Minitel). Despite the potential for change under Mitterand after 1981, Petras (1984) argues that the Socialist government has continued in the same direction, speaking of modernizing French industry by closing down old 'unprofitable' sectors and upgrading the technological level and productivity of declining sectors, with the threat of the loss of 500,000 jobs in industries such as coal, oil, steel and cars.

Avril (1969) traces the origins of the French political faith in technocracy to the 1840's writings of the early French socialist Saint Simon, whose vision of a new society was of government by a leading class combining top industrialists, scientists and artists. The unity of this class depended upon the special role of engineers as the main political managers, whom Saint Simon saw as an ideal hybrid with half industrial and half scientific capabilities. We will see below other aspects of Saint Simonian doctrine related to IRCAM. But clearly the elevated status of engineers, the notion of scientific and technocratic state management, go back at least to these origins.

Turning to the wider political dimensions of these developments, Johnstone (1984) discusses the changing nature of the nuclear technology debate in the 1970's, the period of re-orientation of the French Left after the crisis of 1968. Johnstone shows how, after more than a decade of opposition, in 1977 first the French Communists and then the Socialists adopted a nuclear defence policy based on extension of the *Force de Frappe*. She links this to the virtual disappearance of the French anti-nuclear movement by the end of the 1970's, noting that in 1981 there were massive protests going on all over Europe against Euromissile deployment - except in France. She also sees this policy as both nationalist and imperialist, and aiming at independence from the American nuclear umbrella. Johnstone sums up the political situation thus: "The enormous paradox of Mitterand's election.. is that it came at a time when the French Left was already in the advanced stages of a deep decline" (1984:21). Reader (1987), analysing the reorientation of the French Left intelligentsia since 1968, also sees it as characterised by increasingly uncritical fascination with new technology - an attitude previously associated with the Right. Reader notes, however, the relatively marginal existence of a polarisation on technological issues between ecological and technocratic factions. Overall, with Johnstone, we can cite the position of the French socialist intellectual Gorz, as against his German ecological counterpart Bahro, to exemplify the characteristically uncritical, pro-technological stance of the French post-Marxist Left compared with that elsewhere in Europe. This seems to be but one dimension of the broader reorientation and fragmentation of the French intelligentsia in what has been called its 'post-Marxist' or post modern phase.

In conclusion, we have seen the increasingly central and linked roles of new technology and nuclear civil and defence industries in the French economy since the late 1950's, the heavy involvement of the 'technocratic' state in managing centralised R and D programmes, and the continuity of this policy under different governments including the Socialists since 1981. This has been paralleled by political restructuring of the Left in the period since the crisis of 1968, involving the eventual disintegration of the French anti-nuclear movement, and at the same time a decline in Left critiques of, and general political debate about, new technology; all of which results in the dominance of a unifying technological and pro-nuclear nationalism across the political spectrum. We will see later the implications of these phenomena for the cultural milieu within IRCAM.

Tensions in cultural policy: centralisation and decentralisation

The existence of centralised, highly privileged cultural institutions has long been characteristic of the organisation of French high culture. More generally, the French polity consists of a highly centralised bureaucratic administration centred on Paris (Avril 1969) with local administration largely an extension of central government. The origins of this state centralisation go back to the French Revolution of 1789, from which time centralisation and rationalisation of administration, education and so on have been associated with uniformity, with the end of inherited privilege, and so with increased equality of opportunity and access for all citizens. It is thus not surprising that a concomitant strong centralisation has also been a historical feature of the organisation of French intellectual life, including both the arts and sciences. Hence the existence and the leading national role of major cultural institutions such as the *Académie Française*, the *Comédie Française*, the Paris Opera, or in the scientific sphere the *Collège de France* and the *Centre Nationale de Recherche Scientifique*. The social and cultural effects of this dominant characteristic of the French polity remain much debated. Moreover the centralising tendency has been continuously contested; and this contestation - whether in regionalist movements such as Basque or Breton nationalism, or in the association of French socialism with decentralisation - remains a continuous tension at the heart of French political life. But just how the parties and politics of Left and Right align themselves around these issues is complex.

President De Gaulle set up the French Ministry of Culture in 1959, and gave it the nationalist task of recreating a leading role for France in the arts worldwide. De Gaulle put the novelist Andre Malraux in charge, and under him cultural policy was pedagogic and traditionalist, concerned with the missionary role of converting the people to the great art and culture of the past as a way to unify the national culture. To achieve this meant to decentralise and so create the means for diffusing culture to the regions. Malraux's policy in the 1960's therefore created a national network of '*Maisons de la Culture*' - centres for cultural performance, exhibition and teaching - in every provincial city: a 'popular front' in culture. The new *Maisons* were seen as 'cathedrals of the twentieth century'; art was a new religion, to be worshipped.

By the 1970's, this basic character of policy was changing. The idea of promoting a 'national culture' came increasingly under public attack as encouraging state subsidy for elitist culture. The definition of 'culture' was contested: it began to be identified rather with cultural diversity, difference, conflict and criticism; this was also in reaction to the notion of the mass media as spreading homogeneity and passivity. Under Jack Lang, who arrived as Socialist Minister of Culture in May 1981, the new cultural politics became official. Lang, who had previously been the organiser of the innovative Festival of Nancy, proposed a view of culture based on the creative capacity of all, on culture as experiential and not didactic. Culture was not a national entity, but consisted in different and incommensurable forms. Even as Minister, Lang appeared to align himself with the margins in arguing that "all cultural action must be against power" (Zeldin 1983 p.365). It is an interesting contradiction, then, that as part of the Socialists'

initial doubling of the funding for education and culture, Lang's Ministry continued to give equal support to such elitist and powerful institutions as IRCAM, and that this has continued through the 1980's.

We thus see two cultural political ideologies that appear to centre on an alignment of the opposition between centralisation and decentralisation with that between elitism / paternalism and pluralism / populism. The two ideologies relate to the concepts of modernism and post modernism, as we will later see. But the alignments are not stable, just as their association with the political Right and Left is unpredictable. Thus in practice, as we have seen, Lang's Socialist Ministry has continued to fund the growth of highly privileged and centralised cultural institutions.

The complexity of the issues in relation to cultural politics are well illustrated by the policies of President Pompidou, whose direct patronage led to the founding of IRCAM. Pompidou's policies, during his 1969-74 premiership, can be seen as a sort of middle ground indicating the complexity of policy shifts, and the lack of simple alignments of Left and Right on cultural matters. Pompidou brought a renewed ambition to the Gaullist aim of reclaiming for Paris the role of cultural capital of the Western world. Where De Gaulle's plans for reconstructing national culture came in the wake of the Second World War, Pompidou's came in the aftermath of the social and political turmoil of 1968. Pompidou's term followed the substantial Gaullist victory that served to end the period of civil unrest around May '68. His cultural policies were clearly an attempt to banish divisions through the creation of another popular front in culture. Menger (1983:224) suggests that Pompidou's patronage of contemporary art was also an attempt to consolidate the support of the intelligentsia and high bourgeoisie which had provided the basis of his social and political career, and whose taste for abstract art coincided with his own.

Instead of decentralised yet traditional and pedagogic institutions, Pompidou initiated a new programme of major, centralised cultural institutions that were to be forward looking, contemporary, but also with popular appeal and aimed at a large public. The prototype was the new National Museum of Contemporary Art that was to bear his name - the Centre Georges Pompidou - in the planning of which Pompidou and his wife took a personal supervisory role. Pompidou wanted the CGP to be a European innovation in the development by the state of a centralised yet popular contemporary culture. Here we see the important shift in the terms of cultural policy, whereby it is proposed that centralisation and fine art are compatible with populism. This policy continued throughout the 1970's and 1980's, and underlies the founding of, for example, the new national science and technology museum at La Villette, the new museum of French art - the Musée d'Orsay - and the plans for the new national Opera de la Bastille. It has thus characterised governments of both Centre-Right and Left - first Pompidou, then Giscard d'Estaing, and since 1981 Mitterand and his Minister Lang; so that both sides of French politics have supported this cultural policy.

The founding of IRCAM is directly implicated in these developments. The IRCAM idea came out of Pompidou's personal invitation to Boulez, at the time that Pompidou was planning his new art museum, to take part in the

post-'68 reconstruction of French artistic life (see Appendix 5). IRCAM thus became the music wing of the new CGP. The institute was, then, the result of direct contact between the President and Boulez as a leading artist-intellectual, of their personal visions, and hence of placing power directly into the hands of Boulez. We will see below how the continuing high privilege and power of IRCAM, and its self-conscious leading role, have their precedent in these august origins against the background of the developments in cultural policy described.

The role and character of French intellectuals

De Gaulle's appointment of Malraux as Minister of Culture, and the direct contact between Pompidou and Boulez, raise the role of intellectuals like Malraux and Boulez in policy and government. It indicates the particularly high profile that French intellectuals have taken not only in public life, cultural and political debate, but also in political office. Reader (1987) discusses this phenomenon and the related, yet contradictory, strong traditional links between intellectuals and the political Left - contradictory because the Left has not often been in power. Reader notes the influence of two key historical events: the Revolution of 1789 and the Dreyfus Affair. Inspired by the concepts of liberty, equality and fraternity in the work of Rousseau and the 'ideologues', the Revolution placed the intelligentsia at the forefront of French public life. Reader suggests that two further developments already touched upon that were central to instituting the first bourgeois nation state and to overthrowing the landed aristocracy - "the centralisation of power and authority upon Paris and the educational meritocracy of 'grandes ecoles' " (ibid p.3) - supported this. Since then, Reader argues, Paris has remained hegemonic, not least because it remains the place where the vast majority of the intelligentsia and the civil service are educated and reside. The capital thus also becomes the site upon which the various fractions of the dominant class - intellectuals, high civil servants, businessmen and managers - confront one another.

The Dreyfus Affair was significant, for Reader, in being the first time that leading intellectuals came out in force, behind Dreyfus with an 'intellectuals' manifesto' organised by Zola in 1898, to make an impact on an issue of practical politics that was dividing French society. This illustrates the formation of intellectual 'blocks' across the arts and disciplines, as well as the association of intellectuals with the Left. Reader's book, however, is an analysis of the unprecedented decline of that association in the post '68 restructuring of French politics. Reader discusses 'the silence of the left-wing intellectuals' following Mitterand's 1981 election, and the refusal of certain erstwhile sympathisers (notably Foucault) to take up posts offered to them by his government. He analyses the shift over the last twenty years amongst French intellectuals towards a 'non-etatiste' view of politics, in parallel with a growing distrust of socialism as outdated and out of touch with economic realities; their rejection of grand theory - Marxian or structuralist - and, relatedly, of traditional political forms. Moreover, Reader says, "intellectuals are typically happier in opposition than sully themselves with the exercise of power" (ibid p.138). We will see later how this analysis of the political climate, together with that above concerning political attitudes to technology,

contribute towards understanding the intellectual milieu within IRCAM.

Finally, Zeldin (1983) argues that the French polity consists of two major, rival status and career systems: 'bureaucracy' and 'culture'. This is embodied in an antagonistic division between civil servants and managers, with the role of practical managing, and intellectuals, with the role of thinking and planning - an antagonism fuelled, Zeldin says, by the well known caricature of French bureaucracy as excessively power-conscious, rigid and rule-bound, with a mania for form. We will see in Ch.4 that mutual hostility and contempt between the bureaucracy and the intelligentsia is also characteristic of IRCAM culture.

French and American cultural rivalry: nationalism, internationalism, and the avant garde

The profound nationalism of the cultural policies of both De Gaulle and Pompidou described above can be seen to flow from similar motives. In both cases they follow a period of deep crisis in French society - the Second World War, and the Events of 1968. The notion of a centralised national culture is then brought in as a way of reconstructing and unifying the nation (as before, prototypically, in the Revolution). But there is another important, related force common to both eras of nationalist policy: the desire to recreate a leading international role for French culture in the world, a role that is thought to belong rightfully to France and to have been lost. And this in turn depends upon historical changes in international cultural and artistic hegemony.

Guilbaut (1983) describes the most important such change in modern times: the shift in international cultural and artistic leadership soon after the Second World War from Paris to New York. Guilbaut provides an analysis of this shift and its contribution to the broader establishment of post-War American political-economic hegemony through the policies of the Marshall Plan and the ideology of the Cold War. Cultural rivalry was but one reactive dimension to France's post-War economic and technological dependence upon the USA. On the cultural front, until the War and for at least the previous half century Parisian art had represented the heights of Western culture, and Paris was considered the centre of high modernist thought. But in the aftermath of the War, and given the economic decimation, chronic political and social division in France, Guilbaut says "when New York.. declared that it had at last achieved international status as a cultural center and had replaced Paris as the cultural symbol of the Western World, the French capital was not strong enough, either economically or politically, to protest" (1983:5).

The political instability in post War France led to fragile coalitions, and, given the importance of artistic discourse in French culture, to its extreme politicisation. Guilbaut describes the chaotic results: "In France art and politics were closely related and left no room for neutrality. Each political party and its associated newspapers and reviews championed a style of painting. The vehemence of political conflict was reflected in art exhibits, magazines and museums..." (ibid:203). There were attempts at creating a national cultural unity, such as the 1945 *Union Nationale des Intellectuels* which called for intellectuals to place their "resources at the service of the French

nation so as to assure France's renewal and continued grandeur wherever French thought has penetrated", to perpetuate the "greatness and renown of the fatherland" (ibid:126). But Guilbaut argues that the result of this self-conscious tying of various deep rooted traditions to political positions was that the weight of tradition left no room for the emergence of a new avant garde.

Meanwhile in New York, where Parisian and other European modernist artists had landed as emigres, commentators saw them as unfettered by the chaos of Europe, and as addressing 'virgin minds' able to respond freely to the new abstraction. The painter Leger summed up the results lucidly in 1946: "Does American painting exist? Yes, and it is developing rapidly... It is impossible that a nation which has given itself the best professors and the finest art collections in the world will not one day achieve an original style of its own... I am convinced that the Americans are on the way towards a period of greatness in art" (ibid:127). By the late 1940's, Guilbaut charts the claims by leading American art critics such as Greenberg that a truly national American style - abstract expressionism - had arrived in the work of artists such as Pollock and Rothko. Guilbaut notes that this was simultaneous with the emergence of a large new American middle class market for painting. He shows how, over the next few years, 'Ab Ex' became the artistic spearhead for American high cultural hegemony at the same time that, in Cold War rhetoric, America began to be portrayed more and more as the symbol of Western culture, as the guardian of freedom and liberal human values. Thus gradually American Ab Ex art became the new internationally dominant avant garde.

There were two elements to this shift. First, and paradoxically, Guilbaut notes the necessity of a subtle transition from the perception of Ab Ex as above all an American, national art, to its perception as internationalist and as representing universal humanism. This, in turn, was possible due to the second shift: the depoliticisation of the American avant garde and its embrace of a purely formalist artistic ideology. The core of this identification was the notion that free formalist experiment in art itself enshrined the liberal values of spiritual independence and human freedom: a metaphorical reading of the relation between artistic form and politics which, as I show later in Chapter 9, is central to the ideology of the modernist avant garde; and which in the mid century was also framed against the Stalinist suppression of modernism and imposition of the style of socialist realism in the arts throughout the Soviet bloc. Again, the American ideology was summed up by the critic Greenberg, who said: "[The problem of alienation] can be solved only by an order which reconciles the freedom of the individual with the welfare of society... I believe a good name for such a society is democracy, and I also believe that modern art in its infinite variety and ceaseless exploration is its foremost symbol" (ibid:189). Thus, in the Cold War climate of the late 1940's and '50's, Ab Ex art came to represent, as did American culture as a whole, a liberalism hostile to the totalitarianism of both fascism and communism.

In this way, in the immediate post war period, America achieved a new international hegemony in the arts to match its global political-economic power. Other functions of US cultural hegemony are well

illustrated by its mass forms. The spread of European markets for the American film industry after the War overturned, in France, protectionist quotas against imports that had lasted since the Depression and that had enabled the growth of a healthy French film industry. By 1947, as part of a US deal for a massive loan to France, the protections came down, and the French industry faltered while American movies flooded in. Guilbaut notes that the French public's attitude to American films, and culture in general, was profoundly ambivalent: on the one hand their dismissal as frank and crude propaganda for 'the American way of life', and resentment at the unemployment caused; but on the other a fascination with American wealth, energy and colour.

We can see epitomised in this history a mutual cultural fascination, rivalry and interdependence, with shifting dominance and dependence, that will also be clear in looking at IRCAM. On the French side, the history outlined generated the desire, encapsulated in nationalistic policy from the late 1950's on, to overturn American avant garde hegemony and regain the role of artistic leadership that had been 'stolen' in mid century. But the history also raises two other themes that will later be relevant to IRCAM. First, the curious relation of the avant garde to politics, and the depoliticisation of the modernist visual avant garde that occurred in the post-War period. Second, the tension within the avant garde between nationalism and internationalism, between the assertion of an authentically new voice and the expansive, almost imperialist artistic leadership that respects no boundaries. We saw the critic Greenberg speak first of a special new American style, different from the prevailing Parisian style; and then of an international style with universal reach. This tension too will be relevant to the analysis of the avant garde at IRCAM, and to Boulez's own history. It is interesting to compare the greater complexity of this view to Williams' (1981:83-4), who sees the historical avant garde as above all the first necessarily international position within culture, based on the cultural experiment of emigre intellectuals in the metropolitan centres of imperialist states. In this, despite mention of the shift in art dominance from Paris (1890-1930) to New York (1940-70), Williams underplays the nationalist base of bids for cultural hegemony.

Although this analysis centres on painting, it concerns dynamics within modernism that also affect the musical avant garde. I examine those historical dynamics in greater detail in Ch.9.

The avant garde: intellectual leadership, art and science

We have seen that for the first part of this century French culture was considered a leading force in Western culture, and so epitomised the concept of the avant garde. It is thus no surprise to find the roots of this concept in the influential writings of the early French utopian socialist Henri de Saint-Simon. Shapiro (1976) describes how both Saint-Simon and Fourier, the leading theorists of French socialism, wrote in the 1830's of 'artist-leaders' who were equipped for the role by virtue of their particular sensitivity and imagination. Saint-Simon first applied the term 'avant garde' to culture, referring to revolutionary 'artist-engineers': this drew an analogy with the term's military strategic use, for a scouting party that goes out ahead of the main

force and initiates a skirmish. In Saint-Simon's '*Opinions Littéraires*' (1825), an imaginary artist and scientist engage in conversation. The artist says "It is we (artists) who will serve you as an avant garde", and continues "the power of the arts is in fact most immediate and most rapid: when we wish to spread new ideas among men, we inscribe them in marble or on canvas". Socialist writers attacked the doctrine of 'art for art's sake' and proposed instead that art should become the expression of society - a position that prefigured the rise of socially engaged realist painting soon after, for example that of Courbet.

Saint-Simon's writings provide the basis for another French inflection of the concept of the avant garde. To understand this, we must examine his broader political vision. Saint-Simon envisaged a meritocratic social hierarchy based upon talent and led by professional 'experts' selected for their competence rather than as representatives of a body of voters. Parliament centred on a Chamber of Inventions consisting of 200 engineers, 50 poets and writers, 25 painters, 15 architects and 10 musicians. This view of government by an elite at once intellectual, industrial and managerial - which, as we have seen, still resonates within the French polity - was to be dominated by the new class of engineers. Manuel (1956:ch 27) notes that Saint-Simon was one of the first social theorists to sense their importance in modern civil, as well as military, society. As we saw, Saint-Simon proposed that engineers had an ideal combination of industrial and scientific capacities. Manuel summarises the perspective thus: "If the overriding purpose of all the arts and the sciences was to modify nature, these engineers were society's noblest animals, for they were the primary agents in the application of scientific research" (ibid:312?). Saint-Simon's utopia thus centred on dialogue between engineers, scientists and artists, with artists having both a political role and a leading role in the imaginative exploration of reality. His advocacy of the progressive social and political functions of the arts and sciences put them on equal footing, and enjoined them to engage with each other and with modern industrial applications. Saint-Simon's theories therefore led not only to the development of the concept of the artistic avant garde as a leading force, and to the notion of its political role, but also, importantly, herald the new fascination of modernist artists half a century later with technology and science - a fascination that itself prefigures the phenomenon of IRCAM, as I will argue in Ch.9.

French musical culture and music policy: the modernisation of musical life

I outline in the remainder of the Appendix some recent aspects of French contemporary music culture, including major changes in music policy, that are relevant to the founding of IRCAM; and I relate them to the broader cultural and political forces described above. Boulez's central role in, and influence upon, French contemporary music begin to become apparent; so that I analyse aspects of his personal history relevant to the emergence of his plans for IRCAM, and how he gained the power and authority within French culture to achieve them.

The 1950's saw innovatory developments in French contemporary music, unlike much of French artistic life, in line with the simultaneous

beginnings of a post War musical avant garde elsewhere in Europe - particularly Germany and Italy - and in the USA. There were two such major developments in France, against the background of an essentially conservative and traditional musical establishment. Menger (1983) argues that this establishment, consisting of the most important state music institutions - the *Conservatoire Normale Superior de Musique* (CNSM), the highest training centre for French musicians and composers, the Paris Opera, and the French Radio (RTF) - remained from the 1950's into the '60's generally indifferent or hostile to the new avant garde developments, while their own dominant composition environments remained eclectic.

It is significant that the two composers whose teachings greatly affected the subsequent development of the French avant garde - Leibowitz and Messiaen - were working in obscurity. Immediately after the War these two began to teach the legacies of Schoenberg and Stravinsky, including Schoenberg's composition technique of serialism which became during the 1950's the unifying concern of the newly forming international avant garde. Leibowitz, himself a pupil of Schoenberg and Webern, taught serialism to a group of Messiaen's students from the CNSM, including Boulez who was even then known as the students' leader. Leibowitz was at this time poor and without an institutional post. Messiaen, a mystic and an individual figure in 20th century composition, has nonetheless been one of the century's most important composition teachers. However in 1945, when Boulez and other students began to study with him, Messiaen was mainly employed as a church organist and held only a lowly job teaching harmony at the CNSM. Not until 1966 did the CNSM recognise Messiaen's importance by giving him a chair in composition. Menger notes (ibid:236) that the CNSM, as the main academic institution and guardian of tradition, was the slowest official institution to throw off its mid century suspicion of the new musical developments.

The two innovations in French contemporary music in the 1950's both represent the origins of important and lasting developments. They were, first, the rise of a school of electro-acoustic or tape composition known as '*musique concrete*' with an institutional base within the French Radio that came to be known as the GRM (*Groupe de Recherches Musicales*). And second, the beginnings in 1954 of a regular concert series devoted to avant garde and modern music that was founded and conducted by Boulez and was known as the '*Domaine Musical*'.

'Musique concrete' and the Groupe de Recherches Musicales: music, technology and research

The first development centred upon Pierre Schaeffer, a technician-turned-composer at RTF who from 1948, using the recording technologies and studios of the Radio, laid the foundations of the field of electro-acoustic music. Schaeffer developed a method of tape composition called *musique concrete* based on the manipulation of taped natural sounds - vocal, instrumental, and other ambient, even industrial, sounds and noises - through editing, reversal and speed changes. Under the auspices of the French Radio, the group around Schaeffer and his associate Henry were known first as the '*Club d'Essai*' (1948-51), then the '*Groupe de Musique Concrete*' (1951-57), and finally - continuing after Schaeffer's

departure - took their current name, the GRM (1957 on). Although other electronic music developments went on simultaneously in Germany and the USA, Schaeffer is considered the pioneer of an influential technique and aesthetic. In the 1950's and 60's the GRM, at its base in Radio France, became a focus for many young composers and so fostered an important national French school of electro-acoustic composition and research. Yet *musique concrete* remained unrecognised by the music establishment until the CNSM's offer of a professorship to Schaeffer in 1968 - the sign of official recognition. For a while, the movement around *musique concrete* was then considered to be France's main national contribution to the musical avant garde.

Well known composers were also attracted to Schaeffer's studio in its early days. Boulez and the German Stockhausen, two leading young figures in the '50's avant garde, both visited; and both, having experienced the studio, became in different ways rivals and critics. Stockhausen was immediately involved in the GRM's major European rival, the studio of the West German Radio in Cologne which generated the main alternative approach to electronic music in the 1950's and '60s known as *Elektronische Musik*. Boulez, by contrast, did not continue an involvement in electronics and made known his strong dissatisfaction with the GRM studio and its methods. Boulez's antagonism towards the GRM became a basis, it will become clear, for the later conception and founding of IRCAM. But the GRM was the original French model for a contemporary music and technology centre, and until the rise of IRCAM it retained a hegemonic position as the largest and most important such centre in France. When IRCAM came along in the 1970's it usurped that position. However, the GRM was not an autonomous and dedicated institution; it was part of, and financed by, the RTF, and it was smaller and more nationally based than IRCAM was to be.

Boulez created a stir by denouncing Schaeffer's approach to electronic composition as unsophisticated and inadequate: he "scornfully dismissed (it) as 'a sonic fleamarket'" (Heyworth 1986:14). His criticisms of *musique concrete* centred on it being untheorised and empiricist. The '50's were the period of serialist ascendancy, led by Boulez, Stockhausen, the Italian Nono, the American Babbitt and others; so that any composition not integrating these concerns was liable to criticism, as with Boulez's rejection of *concrete*. The *concrete* technique took 'ready made' taped sounds and manipulated them empirically, manually, in the studio to make the piece. A score of the piece was produced, if at all, after the piece was made, rather than as a prior conceptualisation - the mode of the serialist avant garde, who worked above all to pre-conceived, and highly theorised, plans and scores. Further, and relatedly, Schaeffer was trained as an engineer, and not as a musician, and was thus not considered a legitimate voice on the dominant preoccupations of composition. More will be said on the discursive aspects of these conflicts in Ch.9; but this introduces a major phenomenon of the '50's and '60's musical avant garde: its factionalism, involving polemics, mutual denouncements and criticisms by rival groups. The polemic was not simply directed to the present, but took in the genealogy of modern music. On both counts, Boulez was a prime polemicist.

Despite Boulez's critique, Schaeffer was in fact a theorist. Around

musique concrete he produced a great deal of research on issues which are now considered central to the electronic and computer music fields, culminating in a formidable treatise Traite des Objets Musicaux in 1966; but his research began to be published as early as 1952. Schaeffer and other researchers at the studio worked on the following related issues: how to analyse recorded sounds so as to represent them visually and graphically in score form; how to document the technical basis of tape recorded and electronically based music; how to analyse the timbre of non-musical as well as musical sounds, which Schaeffer, following Schoenberg's concept of '*Klangfarbenmelodie*' (a melody of timbres), considered a major new structural dimension of music. Schaeffer developed the notion of a '*solfege*', or basic syntax, of timbres that could provide a structural basis for *musique concrete*. These questions involved him and his associates in acoustics, study of the physical dimensions of sound, and in psychoacoustics, study of the perception of sound and music. Although these areas of research were also starting up in other countries, Schaeffer's studio were the originators in France. By 1957, the various areas of research were brought together under the new generic term 'music research' and the studio took the name '*Groupe de Recherches Musicales*'. The Greek composer Xenakis, exiled in Paris from 1947, was another visitor to the GRM studio. By the late 50's and early 60's, Xenakis and Schaeffer were both following Stockhausen's lead - (Stockhausen's piece '*Gesang der Junglinge*' (1955-56) was the first to combine natural recorded sounds with purely electronic synthesised sounds) - and producing works combining electronic and taped acoustic sounds; and Xenakis - trained, like Schaeffer, as an engineer and adept at mathematics - was experimenting with the computer as a data processor for musical composition, and as a source of synthetic sound (Manning 1985).

From this brief account it is possible to draw out the relations between the GRM and IRCAM as it came into being in the '70's. On the one hand are continuities largely unacknowledged by Boulez at the time, implying a debt to the GRM as pioneers. All of the research and developments described here, emanating from the GRM milieu from the mid 1950's and early '60's, prefigure major dimensions of IRCAM. For example, the concept of music research, acoustics and psychoacoustics all become very important to IRCAM. In this sense, Boulez's polemical rejection of Schaeffer and of the GRM is ironic. It is also notable that Xenakis, rather than Boulez, was the first French composer to realise the potential of computers for musical work; yet, as we will see shortly, the state resources given to Xenakis for his computer music work have been far less than those eventually received by Boulez. On the other hand, IRCAM culture also overtly represents a strong negation of the GRM aesthetic and technology, in line with Boulez's early critique. Thus we will see in Ch.8 how techniques and technologies associated with *musique concrete* - particularly tape recording, and analogue-electronic, based manipulations of sound materials - are subject to an almost irrational neglect and indifference within IRCAM culture.

Boulez and the '*Domaine Musical*'

Boulez himself was at the centre of the second new development in the 1950's: an organisation called the *Domaine Musical* devoted to producing regular series of contemporary music concerts, founded by Boulez in 1954

at the *Theatre du Petit Marigny*. For at least a decade, the series became the main arena for avant garde and modern music performance in France. Boulez was musical director and the main conductor until his departure in 1966. In 1968 the *Domaine* moved to a large, major venue, the *Theatre de la Ville*, where it continued until ending in 1973.

Boulez's model for the organisation was Schoenberg's Society for Private Musical Performances, set up in Vienna in 1919 in the context of extreme hostility to new music including that of the Second Viennese School. The aim of Schoenberg's Society was to provide well rehearsed performances of new works to a sympathetic audience. Critics and the press were banned, official and commercial pressures were disdained, and publicity was minimal. Schoenberg's influence on Boulez and other young post-War champions of serialism was thus not limited to aesthetic matters. But where Schoenberg's Society lasted only 2 years, Boulez's *Domaine* grew over the 19 years of its existence into a well attended and state backed venture.

It is worth quoting a sympathetic critical account of the *Domaine* which conveys its activities, its particular ideology, and the respect which it gained within intellectual and artistic circles.

"..Pierre Boulez created this organisation in order to fight against the irresponsibility and uninterest of the public and private powers that be towards contemporary music. During the first 15 years of its existence, the *Domaine Musical* revealed to the French public a hundred major classic works of contemporary music that had hitherto been neglected (Schoenberg, Berg, Varese, Webern, Stravinsky) and premiered more than 200 new works by around 60 composers of the young generation from countries all over the world. Under the initial direction of Pierre Boulez and the presidency of Suzanne Tezenas, the *Domaine Musical* concerts, at first criticised and mocked in reactionary circles, played a leading role in French post War musical life and brought to the public a mass of information that was otherwise completely unavailable. They literally created and discovered an audience" (Menger p.219: from C.Rostand Dictionnaire de Musique Contemporaine, Paris 1970, my transl.).

This account suggests that the *Domaine* began as an esoteric and elite meeting point of the avant garde, in reaction against the conservative music establishment. Like Schoenberg's concerts, the *Domaine* adopted an avant garde position, championing new and neglected works, thereby countering established views and courting official disapproval. Yet by the 60's and 70's, the *Domaine* concerts had become an acceptable feature of French high cultural life.

Apparently set up against public and private 'powers', the patronage upon which the *Domaine* depended is, however, the key to its far from marginal social and cultural milieu. For the first seasons, funds were provided by the Renaud-Barrault theatre company, of which Boulez was then musical director. The company's leading actors, the husband and wife Renaud and Barrault, were Boulez's first professional employers and had become his personal friends and patrons. But soon the concerts were taken up by a Mme Suzanne Tezenas, the wealthy Parisian wife of an industrialist who had for some time been a patron of avant garde

artistic circles. Menger analyses in detail the haute bourgeois milieu from which Tezenas came, and the circle of intellectuals and patrons that she drew around her to support the *Domaine* by subscriptions. Many patrons were in fact the wives and relations of the haute bourgeoisie and of artists. Subscribers for the '62-3 season included people related to the following intellectuals: writers and poets (eg Ionesco, Sarraute), artists (Kandinsky, Ernst, Chagall), philosophers (Lacan), musicians (Boulanger, Eloy, Poulenc). Those coming from the haute bourgeoisie included, for example, several Rothschild wives. Certain figures cross the categories: Tezenas relates that it was a Pierre Souvtchinsky, ex-Russian prince and musicologist, who first alerted her to Boulez's talents. Tezenas, interviewed by Menger, evokes the scene thus:

"I knew Pierre Boulez in 1948, well before he became musical director at Jean-Louis Barrault's. It was P. Souvtchinsky, russian emigre prince and musicologist, who brought him to me: Souvtchinsky was part of Messiaen's analysis class, and frequented Leibowitz - he had an inclination for searching out young talent. Boulez came to dinner here with some writer friends; at my home there were writers, painters, musicians, but elsewhere, for example Mme Gould's, there were usually only writers. Souvtchinsky had a great influence upon Boulez, together they brewed up the idea of the *Domaine Musical*. The first season, Barrault took charge, but it was ruinous. I had already helped Vilar [theatre director] to put on a piece by Adamov, with Rene Char. I knew them all, you see. It was Rene Char who said to me 'you must help Adamov, neither he nor Vilar have any money'. That was long before he [Vilar] had the TNP [*Theatre Nationale Populaire*]. It was probably the little association that I founded to help Vilar that gave Souvtchinsky the idea to do the same for Boulez.

At the start, to gain support, one had to flatter people with snobbism. There were, as always, snobs who were looking for novelty. Many of these lacked nerve and dropped out. But there were Nicolas de Stael, Mathieu, the important abstract painters, Michaux, Jouve, Char, Mandiargues, all great friends, gallery directors, women of the world [*les femmes du monde*]. There were gatherings here, at my home, to launch the concerts, that did a great deal. Many people subscribed in order to come here. For ten years, after each concert, until Boulez left in 1966, I gave receptions. The composers used to stay talking until two in the morning.

There were society people [*mondains*], writers, painters, art dealers... People were brought along: all visiting foreigners came through here. I was very close to Gaeton Picon who met Boulez here and who helped us when he [Picon] became director of Arts and Literature [a major section of the Ministry of Culture]..." (ibid:223, my transl.).

This quote explains well the operations of patronage by a mixed social and cultural elite, and Tezenas' role as mediator and catalyst. She had clearly been a patron of the theatrical avant garde before, and had no illusions about the drawing power of artistic talent and of charismatic intellectuals and their role in spreading cultural prestige amongst the bourgeoisie. The *Domaine* became a point of merging and conversion between cultural and economic power. An informant told me that Tezenas' receptions for the *Domaine* concerts were known as 'the last salon in Paris'. Similarly Menger notes (p.223) that hers was simply the latest

in a line of major salons in which a mix of wealthy, artistic and intellectual Parisian circles came together to confer upon the current avant garde - based here around Boulez, son of a provincial industrialist - a powerful social legitimacy. Menger finds that two groups dominated the *Domaine* milieu: 'grande bourgeoisie d'affaires' (the business elite), and artists - the latter, Menger says (ibid:374), signalling a strong alliance between serial music and abstract painting. The *Domaine* and its milieu therefore illustrate well another key feature of the modernist avant garde: its cross-media alliances and interdisciplinary flirtations. Thus Boulez, we will see, considers himself strongly influenced by the Bauhaus, primarily a visual, design and architectural movement, by the painters Klee and Kandinsky, by writers and poets including Mallarme, Rene Char (whose poems provide the text for one of Boulez's major works, 'Le Marteau Sans Maitre'), and Genet. This account also indicates that contacts between the arts, far from purely disinterested intellectual affairs, function to provide a primary social network of the cultured elite, and financial backing for new art.

By the early 60's, as well as the *Domaine*'s exclusive patronage, the state also began to make a contribution - some 11% of funds (c.12,000 fr) for the 1963 season - while about 57% came from subscriptions and gifts from 'friends' (ibid:232). To a limited extent, the state began to add its legitimation to the organisation and its culture. Menger argues that this was but the first important step on the way to the official approval and full state consecration of Boulez and his ventures, a process which was only consummated later with the massive state backing for IRCAM and the EIC.

The account by Souvtchinsky of his 'discovery' of Boulez, which Menger calls wryly a 'messianic vision' (ibid:222), illustrates the extraordinary degree of mystification surrounding the notion of talent and its emergence, and Boulez as the recipient of such projections of mystery and charisma - a phenomenon that will recur within IRCAM culture:

"The appearance of a 'new discovery' is always an unforeseen event in spite of all preparations. Of course, the 'new talent' never arrives alone: there are precursors, an entourage, promotion, rivals; but the lines, the historical currents alight in each epoch, each historical cycle, with a curious self-evidence, upon a single personality where upon the 'discovery' is transformed into the 'chosen' or 'elect'. Simply, and apparently without exertion on his part and without great controversy on the part of others, Boulez was very quickly ranked at the highest levels of the hierarchy of musical phenomena of his generation. Which means that one should never forget that all creativity, and particularly artistic creativity, is an eminently, mysteriously hierarchical phenomenon, a hierarchical field" (ibid:222, note 13, my transl.).

Boulez was therefore already, in the early 50's, a few years after arriving in Paris as an unknown provincial student, moving in exalted circles, meeting patrons and future cultural officials, and becoming known for absolute single-mindedness and charismatic sectarianism. The *Domaine* became an opening to success for young composers. The concerts

served to distinguish between the 'elect' and the untalented; they were an arena in which careers were made, since a successful debut bestowed legitimation and recognition. Thus, one composer recalled: "At the time of the *Domaine*,... there was a kind of scale of values that was tacitly recognised. The *Domaine* exercised such a fascination over people that, once a composer had been played there, they became somebody. I always remember the year that Betsy Jolas was played for the first time, it was as though she'd been given the *Legion d'Honneur*. It was like being recognised" (ibid:226, my transl). Another composer, launched by the *Domaine*, described the process more subtly: "While for the aristocracy of performers, their social circle is more wealthy and worldly, that of composers is more intellectual. At the time of the *Domaine*, the only sanction worth giving to a work was not the reaction of an anonymous public but the judgement of equals: the notion of success didn't exist, only recognition by one's peers" (ibid:225, my transl). Thus legitimacy came not from the positive response of a general public, which was disdained, but from the judgement of the elite and closed, high cultural and intellectual circle of the *Domaine*.

This first kind of bestowal of legitimacy, upon living composers, was complemented by a second kind: the *Domaine*'s programmes included a proportion of older works, as mentioned above; and these were selected by Boulez to represent what he considered to be the classics of the modern era. In doing so, the concerts were not so much reflecting prior aesthetic judgements - since the selection was, as we have seen, initially scandalous to the establishment - but constructing them, creating a canon of classic works and major composers in the context of the post War artistic vacuum in which no such canon yet existed. Thus Schoenberg, Berg, Stravinsky, Varese and the others became elected by Boulez as a genealogy of major composers, from which the best new contemporary work should learn and develop. We will see below how naturally this pedagogic and reproductive role came to Boulez, accompanied as it was by theoretical and polemical writing and teaching. We will also see how these two complementary legitimation functions already present in the *Domaine*, the construction of a past modernist canon and of a present aesthetic and intellectual leadership or vanguard, become central features, far extended, of IRCAM.

Finally, the *Domaine* also indicates the internationalisation of the avant garde. Drawing upon new music from different countries, electing a genealogy of international (mainly European) forefathers, hosting international celebrities as they passed through Paris, the *Domaine* set out to express and influence international musical currents, to imprint Boulez's canon upon the musical world, and to impress an international bourgeoisie and intelligentsia. But it tried to do that on the basis of the strongest cultural national foundations. Here once again we see the tension whereby cultural nationalism becomes the basis of a bid for international cultural leadership; and, in the light of Guilbaut's analysis of Parisian artistic impotence after the War, and of the ascendance of New York in the visual arts, it may be that the *Domaine* represented the main, unified Parisian attempt to wrest back one 'domain' of international cultural dominance, to regain the avant garde initiative. At this level Boulez was simply a useful vessel for broader national cultural desires. Compared with the relatively parochial, national horizons of the GRM in the same period, Boulez's *Domaine* had

far wider reach and deeper historical ambitions; and IRCAM has continued in the *Domaine's* tradition of internationalism.

Developments in French contemporary music policy since the 1960's

French contemporary music policy emerged in the later 1960's in the historical context that I have outlined. It has since undergone changes that amount to various attempts to 'modernise' French musical life. Policy innovations have been in two main directions: production or 'creation', and reproduction or diffusion. They involve an attempt to place France on the international stage of contemporary music, to win for France a strategic and prestigious position at the centre of the international musical avant garde. From policies oriented around reproduction, there is a marked change towards policies directed at production. The production policies promote the social and cultural forces outlined at the start of the Appendix: that is, strong tendencies towards increased scale, centralisation and bureaucratisation in the growth of highly privileged institutions devoted to music production. They show further an increased rationalisation not just of institutions, but also of the technologies and practices of music production, and of the 'musical 'language' or 'system' itself. Although these are all unevenly developed in different institutions, internationalisation is the most unevenly distributed and expresses a hierarchy between institutions.

Factions and power: the Landowski - Boulez conflict

In the 1950's, the state gave little resources to music and attached little importance to its administration. With the creation of the Ministry of Culture under Malraux in 1959, music came under the General Direction of Arts and Literature, within the department for theatre, music and literature. In 1964, following an earlier inconclusive report, a commission was set up to report on the state and problems of French music, and Malraux let it be known that he would create a dedicated service for music - the '*Direction de la Musique*' - in the Ministry, with substantial resources. In the subsequent struggle for power, the following mythicised political events occurred. Many musicians were brought in to consult, and two factions emerged, each with their own candidate for the new job as head of the music service. The first faction, led by the composer Landowski, included some of the old guard of French music, such as the composer Milhaud. The opposing faction, whose candidate was Biasini, the current administrator of the department for theatre, music and literature, included Boulez and Picon (mentioned above by Tezenas), who was by then the General Director of Arts and Literature at the Ministry. Boulez was the intellectual and musical leader of his faction, and produced a set of sweeping reforms. To aid their implementation, since they involved radical plans to change the structure of Parisian orchestras, he became honorary president of the French Musicians Union in 1965. Boulez went on record as saying, of the union leaders, "they react like peasants defending their land" (Heyworth 1973 p.53); yet despite this insensitivity, they appear to have accepted his presidency out of respect.

Heyworth relates (ibid:53) that Picon heard rumours that Malraux was

about to reject Boulez's reforms, and Picon suggested that Boulez write urgently to Malraux to appeal against this. Despite Boulez's letter, which Malraux ignored, and despite the considerable backing of Picon, Malraux did reject Boulez and Biasini and announced measures directly contrary to their plans, appointing Landowski in 1966 as the new Director of music. Heyworth describes the results thus:

"Picon resigned in disgust, and Boulez considered that he had been betrayed... In an article in Le Nouvel Observateur titled '*Pourquoi Je Dis 'Non' a Malraux*', he denounced the Minister's actions as "thoughtless, irresponsible and inconsequential", and dismissed him as a feeble chatterbox. He formally announced, "I am on strike with regard to everything remotely connected with the official organisation of music in France". That meant cutting his links with the Paris Opera, the Radio, and all French orchestras. It also meant refusing a public subsidy for the *Domaine Musical*. In 1967 he conducted a special-appeal concert that raised more money than the state had provided in a year, and resigned from the organisation that he had founded fourteen years earlier... Accompanied by a volley of press abuse, he returned to Germany" (ibid:53).

Boulez had been using Germany as a second home, and at this time went into self-imposed exile from France, basing himself in Baden Baden (where he still lives).

Menger says that one effect of Boulez's 'prima donna' dramatics was to divide French musical life in two: his proponents and his adversaries. He notes further, ironically, that "the affair illustrates well the influence that Boulez had gained in cultural circles, even if this 'defeat' put back by ten years his chance to exercise real power in the official musical life of France" (Menger 1983 p.235, my transl.) - that is, with IRCAM. Thus Boulez was, at 40 years of age, and ten years after the founding of the *Domaine Musical*, a controversial and well-known public figure; and in the next section we will see that this incident was not the last high profile political controversy involving Boulez. It is interesting to note the criticisms that Boulez levelled at Malraux in his polemical article. The main point was that the administration of music should not be in the hands of 'failed composers' (implying Landowski, Milhaud and others from their side) but needed a specialised administrator. "The control of music is neither an honour, nor a trust... It is a function.. and a function that needs specialists" (Boulez 1986:443). Boulez's second complaint was about divorcing music from the close relation it had enjoyed with theatre and the other arts under the old system. He says:

"Is it good to separate music from general cultural affairs?... The organisation of music cannot now depend on ossified, out-of-date methods. Use must be made of more general organisms, which also deal with dramatic performances and exhibitions of paintings as well as concerts... This is the price that must be paid if we are to contact the young, a public that is new in both social formation and aesthetic aspiration. It is sheer idiocy to ignore a collective phenomenon of this size... In the present case separating the theatres from concert-giving organisations is tantamount to giving up.. any attempt to solve the musicians' employment problem" (ibid:442).

The quote illustrates two further strategic and continuous elements of Boulez's discourse: his claim to a 'special relationship' with the young, as spokesperson for their needs and aspirations; and his attention to apparently sociological matters related to music and culture - here the problems of attracting audiences, and of musicians' employment.

The Landowski era: diffusion and internationalisation

In passing in his article, Boulez charged Landowski with being reactionary, conservative and academic. Yet Landowski's era at the head of the new Direction of Music is generally considered a successful one for contemporary music, marked from 1967-73 by two major policy initiatives that fundamentally reformed the diffusion of contemporary music. They were the beginnings of, and a sharp rise in funding for, specialist performing ensembles dedicated to contemporary music, such as the groups 'Itineraire', 'Ars Nova' and '2e 2m'; and an enormous increase in specialised festivals devoted to the avant garde and contemporary music, such as those of Royan, La Rochelle, Sigma of Bordeaux, Metz, Avignon, and the '*Semaines Musicales Internationales de Paris*' (SMIP). Both the ensembles and festivals were associated with composers - some ensembles having young french composers attached to them. But Menger argues that the festivals were above all concerned with bringing to France, and so making France the crucible of, the latest international avant garde musical developments. In this the organisers were contesting the dominance of Germany and the United States in contemporary music creation, exploiting the new excitement generated particularly by Royan and the SMIP "to combat the fascination exercised over creators by sanctuaries of artistic innovation like Donaueschingen, Darmstadt, Cologne or New York" (Menger 1983:239). They were also, therefore, continuing what Boulez had pioneered in the *Domaine* musical.

Menger looks in detail at two major festivals, Royan and the SMIP, that exemplify these developments. Both were directed by music critics: Royan by Claude Samuel, and SMIP by Maurice Fleuret. These critics-turned-administrators were a new breed and represent the start of the specialisation that Boulez had called for. The festivals became a means of political advancement, so that Fleuret went on to become the Director of Music in 1981 under the Socialists. The festivals had three major interrelated functions: diffusion of avant garde music, canonisation of the great and talented avant garde and their works, and education - informing the cultured public about the avant garde scene, its ideology and aesthetic. Menger says that, like the *Domaine*, the festivals played a three-generation mix of modernist 'classics', confirmed as such by their selection: works by the dead and older generation, the precursors; works by the principle european avant garde composers, now increasingly established as such, again, precisely by their selection; and works by the young 'disciples'. Menger speaks of the creation, among professional circles - the international community of composers, publishers, critics, managers, agents - and among the public, of an image of 'modernity' centred on a 'symbolic pantheon' of elected composers: especially Boulez, Xenakis, Stockhausen, Berio, Nono, Messiaen, Cage. These composers' works, Menger says, formed the backbone of the programming of the two festivals for 15 years. Thus Samuel came to direct, as well as

Royan the festivals of La Rochelle and Metz where, Menger says, "Stockhausen, Xenakis, Berio, Cage, Boulez and their disciples were constantly starring" (ibid:238 my transl.). The policy was therefore a judicious mix not only of generations, but of nationalities: many French composers, mixed in with international stars and new discoveries, so that international prestige rubbed off on the French, who grew in stature by association. France was thus inserted into the international diffusion of the avant garde, and in doing so gained a legitimating role. But the festivals were not, in fact, renowned outside France; they did not contest the role, for example, of the main meeting point of the musical avant garde, the festival at Darmstadt in Germany, so that their power was limited.

Menger discusses a further aspect of the Paris SMIP festival, which around 1968 became the most publically successful show case ever of the musical avant garde. Concerts were full, mainly of the young who were completely new to the music and brought enthusiasm and curiosity. Fleuret, the director, described it thus:

"This avant garde music came progressively to be a means of expression for the new generations and like a weapon in the generation struggle. Everyone, in 1968, advised me against organising the first festivals in the way that I wanted: that is, dedicating 1 or 2 days to just one composer.. everyone said it was doomed. If we had so much success, if we had to turn people away from almost every concert, that's because my approach was answering not so much a musical need, but a psychological one: this was 3 months after May '68, there was no risk, listening to Xenakis was like killing the father" (ibid:241 my transl.).

This politicised reading of the musical avant garde by French youth around '68 again raises the question of the avant garde as a political as well as an aesthetic phenomenon; yet Menger argues that it was conjunctural, and that the large enthusiastic public of French youth that was generated had dissipated by the '70's - the era of disillusion of the French left, and of the rise of IRCAM.

From diffusion to production: IRCAM, centralisation and rationalisation

Music policy in the 1970's under Jean Maheu (later, in the '80's, President of the CGP and of IRCAM) witnessed a massive overall increase in the funds for contemporary music. The total spent on both production and diffusion rose from c.4.1 million fr in 1974 to c.29.9 million fr in 1978: a seven-fold increase (Menger 1980:15). This included small increases in support for festivals and composers' commissions, but enormous increases for specialised ensembles, and for a new phenomenon: what were called, echoing the title of the GRM, 'centres of music research'. The main reason for the enormous rises is that by 1978 the ensemble budget included funding for the EIC, IRCAM's orchestra, which started in 1976, while that for music research centres included - via another part of the Ministry - the budget for IRCAM, which began operating fully in 1977. Table Ap5.1 compares the changing distribution of funds between different sectors for 1974 and 1978, for those receiving most funds. Thus, although big funding increases went to both diffusion and production, in absolute terms the figures show a major and unprecedented change of policy towards the support of music production

Table Ap5.1 Comparison of main recipients of Ministry of Culture funding for contemporary music, 1974 and 1978

	1974	1978
Direct aid to creation		
- Composers commissions	525,000 fr	1,072,500 fr
Aid to specialised diffusion		
- Special ensembles (including the Ensemble InterContemporain)	861,500 fr	9,122,000 fr
- Festivals	2,253,000 fr	3,488,000 fr
Aid to music research centres		
- Other music research centres (funds via the Direction of Music)	235,000 fr	1,530,000 fr
- IRCAM (funds via the CGP)	131,500 fr*	12,000,000 fr
TOTAL	4,122,500 fr	29,885,500 fr

* IRCAM was mainly in administrative preparation before 1977.
(Adapted from Menger 1980:15)

Table Ap5.2 Comparative subsidies for contemporary music ensembles in 1979

EIC (Ensemble InterContemporain)	5,983,000 fr
2e 2m	756,000 fr
Itineraire	609,105 fr
Ars Nova	514,000 fr

(Adapted from Menger 1980:47)

Table Ap5.3 Comparative subsidies by the Ministry of Culture for centres of music research and of electro-acoustic production, 1973-82, in millions of francs

	1973	1975	1977	1980	1982
Research centres					
IRCAM, Paris (Boulez*)			10.5	14.9	28.4
CEMAMU, Paris (Xenakis)	.015	.15	.26	.39	2.34
GRM, Paris					.10**
SON/RE, Paris (Henry)					2.26
Studio, Paris (Eloy)					2.02
ACROE, Grenoble			.17	.26	1.38
Phonetics Lab, U. of Aix-en-Provence					.37
Electro-acoustic centres					
CIRM, Nice	.015	.018	.019	.025	.15
GMEB, Bourges		.06	.60	.66	.97
GMEM, Marseille		.04	.10	.22	.45
CERM, Metz			.15	.26	.30

* The names in brackets are those of composers whose centres or studios these are, or who are closely associated with the centres.

** The GRM had been financed for decades by Radio France, hence its late and small subsidy by the Ministry.

(Adapted from Menger 1983:140)

and 'research' rather than diffusion, in the form of the new 'music research centres' which in 1978 took between them nearly half the contemporary music budget. To get this into perspective, in 1978 compared to IRCAM's 12 million francs (3.5% of the total state music budget) the Paris Opera, the highest publically funded music institution, received c.150 million francs (43.5%), and the CNSM, the second best funded single institution, received c.23 million francs (6.7%. From Menger 1980:14). All three figures illustrate, however, the strong centralisation of French musical life around the dominant Parisian institutions.

Centralisation and rationalisation were also the main forces operating in the new policy of music research centres; and centralisation at two levels. First, and most profound, the notion that music composition, considered for at least 300 years the preserve of individual and isolated creativity, should be based within institutions comprising collaborative group activity involved an unprecedented centralisation of this creative labour; and its rationalisation within a division of labour including not just composition, but also related scientific research and technological development. But in addition to these developments common to all the centres, the policy fostered a higher level of centralisation in the absolute dominance that was given to IRCAM as a centre over all the other centres; and similarly, in the EIC's dominance over the other contemporary music ensembles. IRCAM's dominance and privilege has several dimensions, the most obvious being that of the funding for both it and the EIC. Tables Ap5.2. and Ap5.3 illustrate the funds for the EIC and for IRCAM compared with their main and best funded rival organisations. The EIC has about eight times, and IRCAM more than thirteen times, the funds of their nearest Ministry of Culture funded rivals. Menger says that in 1978, for example, IRCAM's 12 million franc subsidy was 40% of the total state budget for contemporary music, and of the remaining 60%, the EIC - attached to IRCAM and also directed by Boulez - took 30%. "If we add that the budget for the INA/GRM [the GRM, funded by the RTF], historically the most important french research centre, was in 1980 equivalent to 6 million francs (two-fifths of IRCAM's budget in 1980), it becomes clear that the particularity of (music) research lies in its exceptional concentration of material resources" (Menger 1983:122-3 my transl.). Overall, the strong centralisation of funds upon IRCAM and the EIC is evident.

Table Ap5.3 also shows the rapid rise in the number of centres for music research and for electro-acoustic music in the period 1973-82. In 1973 there were just two, in 1975 four, from 1977-'80 in addition to IRCAM there were six, by 1982 seventeen, and by 1984 twenty-five centres. This exponential growth received its biggest boost after the Socialists came to power in 1981, and I discuss the reasons for and results of this policy shortly. By comparing IRCAM with the smaller centres, other dimensions of IRCAM's privileged and dominant position within the national field of centres become apparent: its greater scale, involving a bigger bureaucracy; its administrative autonomy and unusual constitution for a public institution; and its internationalism. IRCAM has a staff of about 55 supplemented to around 100 by visitors and contract workers, including a well developed bureaucratic administration. Most other centres have less than ten staff and little bureaucracy; the majority are small, relatively informal outfits. IRCAM

staff include a number of musicians, scientists, researchers and technicians working alongside one another in groups: an extended division of labour compared to the few members and lesser specialisation of the smaller centres. Administratively, although attached to the CGP, IRCAM is an autonomous institution with its own bureaucracy and receives its funds directly from the Ministry of Culture via the CGP as intermediary. All other centres receive their funding through the Direction of Music, and so IRCAM alone is not dependent on the Direction. Other centres are either small independent associations, or sometimes part of a University department. Unlike all the other public institutions, IRCAM has been granted an exceptional legal status, allowing it to enjoy a mixture of private and public patronage, and to employ a high percentage of foreigners. Where the other centres are primarily nationally based and employ French workers, IRCAM employs many Americans and other Europeans; and it has linked into international computer music and other high culture and music circuits, many of them North American, through which it primarily exchanges and communicates and which it therefore considers its main network. Thus, IRCAM's privileged position involves an entirely different scale of resources, operations, ambitions and output to the other French centres - differences of both size and character.

What is the meaning of 'music research', the rubric underlying the new policy? We saw earlier how the concept arose as a generic term subsuming the studies made by Schaeffer and colleagues around *musique concrete* in the 1950's, and later at the GRM. These studies included acoustic and psychoacoustic research, and were also closely tied to their electro-acoustic, tape-based technological experiments: from how to analyse aural tape music so as to represent it in visual form, to the meaningful analysis of non-conventionally musical sound so as to make it useful as musical material. These problems show how music research, at its closest to music, involves the analysis of musical structures and sounds using appropriate technology and scientific knowledge. It potentially therefore feeds back into composition by aiming to create new sound materials and musical structures - now much intervened in by technology and by scientific analysis and analogy. Music research, in other words, refers to areas of interrelated scientific and technological development around, and intervening in, the production of music. Menger analyses the wider spread of the concept thus: "It is during the 1970's that electro-acoustic activities transformed themselves.. into generalised music research; founder of a musical future, source of fundamental and applied scientific and musical knowledge, and particularly allowing composer-researchers to redefine the conditions in which their activities would be evaluated... Creative invention was rationalised" (Menger 1983:124 my transl.). From roots in the GRM, the concept appears to have flowered at IRCAM; yet, we will see in later chapters that in fact it remains somewhat anomalous there. But a deeper precondition underlies the rise of music research: what Menger calls the 'intellectualisation' of music through a proliferation of discourses accompanying, theorising, explaining and evaluating music, which draw heavily upon the natural and human sciences.

However, although we have traced here the recent rise of these discourses within French music, I argue that in order to account fully for the intellectualism, theoreticism, scientism and the technological

bent of IRCAM's music research we require the greater historical depth provided by an analysis of the character of modernism since the early part of the century, which I provide in Ch.9.

Socialist policy and public controversy

In this section, I review changes in the policy on music research centres under Fleuret, the new Director of Music within Jack Lang's Ministry of Culture, following the 1981 Socialist election victory; and I show their relation to public and political conflicts and controversies that have surrounded IRCAM during its history. In the following section I discuss recent views of officials from the *Direction de la Musique*, the public body ostensibly responsible for contemporary music but, as we saw, with little power over IRCAM. Controversies centre upon the dominance of IRCAM, the role of Boulez, and questions of the legitimacy of IRCAM's work. Examining them gives an understanding of how IRCAM's privileged place within state cultural policy has been perceived, defended and questioned, the forms in which its legitimacy is assessed and, most interestingly, the limits to questioning its legitimacy. We therefore gain insight into IRCAM's external reproduction: how its continued existence is justified within the Ministry and the broader public sphere.

When the Socialists came to power in 1981, their best publicised post-election gesture was to double the state budgets for education and culture; and indeed IRCAM's funds immediately doubled from about 15 to 30 million francs a year. But rather than simply increasing the funds to existing centres, the new Director of Music, Fleuret - despite his 'suspicion of institutions' - created a number of new music research and electro-acoustic centres, and augmented their funds at a comparatively higher rate than IRCAM's. The recent centres included a couple in Paris, notably two studios created for the established composers Eloy and Henry (co-founder of *musique concrete*); but the majority were regional, in provincial cities (Lyon, Marseille, Aix, Grenoble etc). The move expressed a desire on the part of the Socialist administration to lessen the monopoly enjoyed by IRCAM and by Boulez, and the dominance of Parisian centres: to decentralise. It also illustrates how centres have often been created around well-known composers; indeed after (Schaeffer and Henry's) GRM, the earliest centre was Xenakis' CEMAMU (*Centre d'Etudes de Mathematique et Automatique Musicales*). Xenakis, as we have seen, was the first French composer to work closely with computers, and has been a major figure in the avant garde; yet his centre remains a small affair compared to Boulez's IRCAM. These 'centres autour du compositeurs', strongly identified with their composer-directors, rivalrous and factional, thus resemble individual empires set up by the state to reflect a composer's stature. A spokesman from the Direction of Music said of Eloy's electro-acoustic studio, for example, that Fleuret created it because the state had not yet demonstrated enough support for Eloy, to match his authority. But we see below that, in fact, this is not the whole story.

Thus, under Fleuret, the boosted music budget was used apparently for the classic French Socialist ends: for decentralisation and cultural pluralism, specifically by decentralising the music research centres. Fleuret's ideology was of musical pluralism and populism, based on the

equal validity of different musics, of '*les musiques*'. He expressed it thus:

"There is no unity, no common language... For the first time in the history of humanity, the West lives without a dominant theory... The more (artistic) risks there are, the more the collectivity must intervene so that things exist despite the risks... (The administration of art) must first of all give to the maximum, to those who have none, the means to express themselves... Everything (ie funding) has been multiplied by two for (music) research and creation, also for jazz, improvised music, traditional and popular music... We are above all else preoccupied with reducing artistic inequalities" (Le Monde de la Musique July '84:98, my transl.).

A junior of Fleuret's regime explained:

"Fleuret's principle was that we are not capable of judging today, so we must create a greater diversity of music to be heard and played; but above all not limit the possibilities by a judgement... It was above all the idea that there's no official art and that one should allow all" (JPO/HG int, my transl.).

How did Fleuret's radical pluralism work out in practice? There were two, unequal, wings to his policies. Although he started the first direct state intervention in popular musics - regional training centres for singers, help with diffusion and record distribution - it was a relatively minor initiative, limited to education and distribution. By contrast, Fleuret poured resources into serious contemporary music, now centred on the music research sector, through his decentralisation / diversification policy. Thus, popular musics fared poorly. And if we critically assess the regional initiative, it emerges that rather than representing local developments, these centres were set up around ex-members of the GRM or IRCAM: well-known researchers, associated with the prestige of the big institutions, as yet without their own base. In 1980, when the co-directors left IRCAM after Boulez's 're-organisation', some of them were then offered by Fleuret's deputy, Michel Decouste (also ex-IRCAM), to run the new centres. Notably, local musicians, including those in popular musics whose aesthetics and reproduction are also dependent on electro-acoustic studio work - jazz, rock, pop, 'variété' - were not given access.

Fleuret's radical policy of pluralism and openness, then - known as '*une philosophie d'ouverture*' - had the limited and exclusive aim of combatting IRCAM's quasi-monopoly of resources in the music research field. Fleuret 'opened out the field', but mainly by resourcing dissidents and associates from the two dominant institutions. Clearly, the policy was driven by hostility to IRCAM's hegemony, and to its extreme centralisation of the field. One of Fleuret's main criticisms had been that IRCAM favoured a certain aesthetic, due to the dominating personality of Boulez. So the new centres were seen by Fleuret as a means of planting the seeds for different ideas, aesthetics and approaches to grow. However, manned by ex-members and people trained in the traditions of the GRM and IRCAM - both widely considered to have fostered 'house styles' - not only the social, but also the aesthetic, diversity of the centres were clearly much constrained.

Fleuret's decentralising policy, then, was not so much about authentic

regionalism, nor about resisting the centralisation of music production within institutions, nor about giving the means of production to unknowns or newcomers; nor about allowing very different musical traditions access to electro-acoustic studios. Rather, it created a set of small centres anchored within the major, existing traditions of the GRM and of IRCAM and so, paradoxically, reinforced those paradigms. The 'risks' of too great a cultural difference were thus avoided. Further, we saw above how, far from equality between the various music research centres, the sector remained ridden by inequality. Financial differentials lessened under the Socialists but were still enormous; and a metropolitan-provincial snobbery existed between the Parisian and regional centres. These developments therefore illustrate the contradictions and limits of the Socialist ideology of cultural decentralisation, pluralism and populism. In fact, the Socialist regime was content to co-exist with, and to placate, existing forms of cultural power; so that the Minister Jack Lang - like Fleuret, as we have seen, apparently a critic of cultural power - was often to be seen frequenting IRCAM's most prestigious premieres.

We can see some of the operations in the reproduction of cultural power in the following developments, which lay behind Fleuret's policy. The criticisms of IRCAM made by Fleuret were not his alone: they were being articulated in public debate and press polemic from at least 1980, especially in the period after Boulez's 're-organisation' of IRCAM. Critics used this to accuse Boulez of concentrating his total power inside IRCAM, of banishing opposition and dissenting voices: once again, of centralising his control, even inside the institute. Polemic was unleashed in the pages of daily papers and the main music magazines, and has continued periodically since. The most stinging and significant critiques of Boulez's 'regime' in the post-coup period were twin articles by the composers Xenakis and Eloy that appeared in the pages of the daily paper Le Matin in January 1981. They were also extraordinarily strategic: months before the election which brought the Socialists in, both Xenakis - known as a stalwart Socialist intellectual (Reader 1985:139) - and Eloy provide what amount to programmes for redressing the crises in French music policy represented by what they argue are IRCAM's failings and abuses of power. We have seen that Xenakis had good reason to complain, since although his relation to electro-acoustic and computer music has been far closer than Boulez yet, as he argues in the article, his CEMAMU centre remains relatively starved of resources. Both Xenakis and Eloy cite the irony that Boulez, who has never as a composer been concerned with technology or computers, is in charge of IRCAM.

Xenakis centres on the contradiction that IRCAM's reputation is at an all-time low, yet it receives an inordinate amount of funding that deprives other ventures. He criticises the 'policy of centralising artistic activity' as the cause of the trouble:

"It's an obvious contradiction to want to impose, in a country where democracy is a word not used in vain, an institution that drains the financial resources for music creation to such an extent that in fact it inhibits that creation" (Xenakis, Le Matin 26.1.81, my transl.).

Eloy is harsher: his piece is called 'The reign of lies', and consists of a series of denouncements. Boulez has "always shown a distrust, indeed a dislike, for electro-acoustics"; his reason for IRCAM is to

follow the path of the USA, where computer music has been the "ultimate refuge for academic post-serialism... IRCAM, since its foundation, has been nothing but a projection of the will for power" (Eloy, Le Matin 26.1.81, my transl.). In another scathing piece, in Le Monde de la Musique (the major French music magazine), Eloy praises Xenakis by implied contrast with Boulez:

"Xenakis.. is an ethical man, unlike the usual custom of the Parisian music milieu. Computer music, for him, is not at all a matter of Institutions and of domination: it is a tool to put at the service of men" (Eloy, Monde de la Mus Jan. '82, my transl.).

Eloy continues that IRCAM is technologically out of date; that Boulez's gesture at running an open-door invitation policy towards other groups and composers is empty, "a non-existent pluralism". Pluralism, Eloy says, is a valuable idea: "a guarantee of a diversity of policies, of a multiplicity of choices, of a divergence of aesthetics". But at IRCAM this is a sham:

"Boulez only respects those who have money: 'You are subsidised? I open my door to you. You have no money? I scorn you'. This is the profound morality of this great artist... In the musical life of this country we have two worlds: on one side, the subsidised club, who only let in others agreed by the club; on the other.. you, me, and many others" (all Le Matin 26.1.81, my transl.).

Fleuret's policy came shortly after, and followed closely, these public critiques by two well-known composer-intellectuals, rivals of Boulez. However, the polemic was not disinterested: both Xenakis and Eloy benefited personally from the new policy. As shown by Table Ap5.3, Xenakis' CEMAMU received a nearly six-fold increase in funds between 1980-82, while Eloy, as mentioned, got his very own well-funded centre. Within a year of denouncing the clubby politics of subsidy, Eloy was himself subsidised. Socialist music policy was, then, a curious compromise which failed to dismantle the centralisation of resources upon IRCAM and 'decentralised' by spreading the goods to rivals from within the same discourse, in order to quiet their complaints.

IRCAM, legitimation, and external reproduction

Following Bourdieu and Williams, the legitimation of dominant public sector institutions such as IRCAM must rest on a sufficient accumulation of cultural capital. If the main ideological opposition to IRCAM, in the guise of Socialist cultural policy, balked at challenging IRCAM's hegemony, it is instructive to examine the criteria by which IRCAM's legitimacy is assessed, both in general, and since the early 1980's by the Direction of Music, the public body closest to IRCAM. It is important to remember that the Direction does not control or fund IRCAM, whose funds come straight from the Ministry via the CGP. However the Direction manages and funds all the other smaller music research centres; so it has a semi-adversarial and rivalrous relation with IRCAM - the one highly privileged institution beyond its control - while it is the main public body dealing in IRCAM's area of expertise. Thus, powerless in reality to affect IRCAM, Direction officials nonetheless articulate informed views held within the Ministry.

Direction officials see the current music research sector as two-tier:

IRCAM, and the rest - the other centres controlled by them. The relation between the two is described both as complementary - that the two spheres have different functions and aims; but there is also a hint of critique, and envy, of IRCAM's dominance and a questioning of its legitimacy. There are three arenas in which IRCAM's legitimacy is discussed: its general cultural politics, technology, and music. Regarding cultural politics, there is a dislike of Boulez's 'absolute power' and influence at the highest levels of the state, a sense of democratic outrage that "neither the Director of Technology nor of Music has the force to intervene at IRCAM, with a personality [Boulez] who is content to go to the highest and most powerful..." (JPO/HG int). Officials speak cynically of IRCAM as 'official art' because of the dominance of Boulez's personality and of his aesthetic, whereas the small centres are considered more free, anarchic, open. "They have no art directors, no directing people..." (JPO/HG int). IRCAM is seen as institutionalised, smothering individuality: "It's a bit dangerous that it's not an individual using the things to make music, but an institution... One loses the naivety in this machine. At IRCAM, as with movements like Surrealism, with a theory, manifesto, one loses the different personalities,... by manipulation into a theoretical position: there's something else than music at IRCAM!" (ibid). Finally, there are doubts about IRCAM's management of its relations with the private sector, especially with certain big foreign corporations with which it interacts. There is unease that relations are informal, uncontrolled, so that massively state funded research, for national ends, will find its way into foreign, and capitalist, hands: a ludicrous abuse of IRCAM's position.

Technologically, IRCAM and the other centres are seen by officials as having different aims and requiring different assessment. The small centres are required to operate a short R and D cycle, showing results - products, tools - at the end of 2 or 3 years. They are supposed to work on applied technological research, to bridge the gap between basic research and commerce, to "find holes not perceived by the private sector.. things in between, effective products. The private will not develop things like the 4X [IRCAM's synthesiser], the SYTER [The GRM machine] that are very powerful but correspond to a small market". The small centres are also enjoined to search for other funds, "to use their imagination to assure their survival". Thus, to gain the external legitimacy and continued support of the Direction, the small centres have to show more immediate results, and to operate a mixed economy.

IRCAM, by contrast, is seen as doing 'fundamental' or basic research, not applied. It does not have to show short term results or products, and should seek areas of research absolutely not covered by the private sector. However, as the following quote shows, there is some confusion about precisely the legitimate position for IRCAM to take:

"They've resolved around the classical areas of research not done by the market: room acoustics, psychoacoustics. This legitimisation is immediate.. I think some private companies take this research. (On the other hand) the products that (IRCAM) creates are not commercialisable; public institutions don't have the economic necessity to need to develop commercial products. But the research is different: basic research can be applied industrially.. But this is not the aim of the Institution, to develop things for the private sector, nor to develop products!"

Thus, IRCAM does not have to seek other funds, or sales of products. It is assured a basic continuity of funds, of credit from the state.

"IRCAM also has to do its budgeting, tighten its belt.. But there's a basic continuity of largesse in terms of employment, the institute". We see in Chs.5 and 6 how several oppositions mentioned - of basic (pure) to applied, long term to short term, research to product development - also recur strongly within IRCAM culture.

Ultimately, an official expressed the question of IRCAM's legitimation in this interesting way:

"They search themselves, ask themselves, year by year.. to find their justification. 'What should we do?' they reflect.. They ask themselves for the justification of music research and computer developments. 'Is our work a little bit more sophisticated than that (software, for example,) on the market?' When, in a few years, we find on the mass market some good, cheap, well-performing products - that'll be the justification!"

The official view thus seems to be a combination of hope and the belief that IRCAM is ultimately subject to a process of self-legitimation, self-monitoring and assessment: the criteria of external valuation and judgement seem confused and irrelevant.

On IRCAM music, officials were equally evasive concerning mechanisms of judgement by the Ministry. We saw above that Fleuret's attitude was in any case to avoid present judgement in an open aesthetic pluralism. Pressed, officials spoke thus: "Boulez is someone who's very interested in youth: there have been some disasters but.. there have also been some good discoveries (of composers) - for example Manoury, Benjamin". They stressed also Boulez's absolute ties to IRCAM: "Boulez holds strongly to 'his institute', he considers it completely new. He's been made several other propositions: to direct the Paris Opera, the Paris Orchestra. He gets involved, but refuses to take responsibility.. He resists and stays with IRCAM: because he believes in his symbol of IRCAM, he sees IRCAM as the most important, a research centre, a vanguard". Asked what has Boulez done musically since the premiere of his major work 'Repons' two years previously, officials laughed and answered "'Repons'! a new version..." Thus 'Repons' appears to bear a great deal of the weight of legitimising IRCAM, since music, and Boulez's music above all, remains the main arena for assessing the results of IRCAM. This is another key to the elusive nature of IRCAM's legitimation, since music and aesthetics are, compared for example with technology or research, perhaps the least tangible and 'objective' spheres of value. Fleuret's views, moreover, by emphasising the rights to produce music, obviate the question of legitimation by audiences, the problem of demand for music; and in this, they fail to challenge Boulez's position on demand, which involves a rejection of the 'mass public' ('la grand public') and of legitimation by public 'enjoyment' at all (see Appendix 6).

It becomes clear that both public and informed official discussion of IRCAM returns again and again to Boulez: the institute is, in France at least, closely identified with the man. In Appendix 6 I examine Boulez's personal history in order to show why he exerts such fascination and charisma, and how his cultural authority has been attained.

Appendix 6 IRCAM's conditions of existence (2): Boulez's life and work: the construction of cultural charisma, authority and power

"I have absolutely no cultural authority. At IRCAM, we try to foresee. That's not an authority"

(Boulez, Le Monde de la Musique n.24, June 1980, my transl.).

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Question: "In the sense that you exercise cultural authority and power..."

Answer by Boulez: "Ah no! I have absolutely no cultural authority! You see..."

Question: "But after all, you have IRCAM!"

Answer by Boulez: "But that's not something one can call cultural authority. These are completely strange notions to me. At IRCAM, we try to foresee certain directions that music could take, and to give them a chance to manifest themselves. That's not an authority"

(The same passage unedited, same source, my transl.).

In Appendix 5 we saw evidence of Boulez's charisma and public authority, and of the admiration, ambivalence and envy this can engender in rivals. We also saw - in the *Domaine Musical*, in the Landowski / Malraux debacle - significant episodes that have contributed to building his renown and stature. In this Appendix I discuss further aspects of Boulez's personal history in order to bring out the strategies by which he has achieved the degree of cultural authority that has justified the enormous power and resources invested in him, at IRCAM, by the state. At the same time, I illustrate the quality and character of Boulez's musical philosophy and intellectual perspective. These lead into examining Boulez's original vision of IRCAM, and the various influences on his ideas.

I show that the key to Boulez's attainment of authority - his singular strategy, unmatched by most other major figures of the post War avant garde - is his combination of both productive and reproductive skills, in three distinct but related areas: as a composer, as a conductor, and as a theorist, writer, polemicist and educator. In this way, he controls every aspect of discourse: not only its production, but also the conditions of its production - ie its reproduction, and so legitimation. In addition Boulez is politically, and culturally politically, active, which we have seen so far at the national level; but he is also active at the level of the politics and intrigues of the international music and avant garde elites. I argue that the combination of production and reproduction, of national and international prestige, is a potent one which has resulted in Boulez's unusually high profile as a musician and intellectual; and particularly in France, where he has a pivotal role linking France to international music currents, and where no other national figure has developed such a combined and unassailable front.

The 'achievement' of charisma and authority is not Boulez's alone. By analysing accounts of the man I show that charisma and authority have

been richly invested in him, constructed in mythic and heroic representations. This can be illustrated initially by the two quotes above: the first an edited highlight taken from an interview with Boulez in the major music magazine, Le Monde de la Musique, the second the full transcript of the same passage. Juxtaposing the two shows how the magazine editors, by editing and highlighting, extremify Boulez's statements so as to make of them an even more highminded and provocative denial of his obvious authority and power than the original: making of it a charismatic challenge. We saw in Appendix 4 the broad interests at work behind the construction, here by the French music press, of Boulez as a charismatic and authoritative figure: ie in the French desire to gain international cultural prestige through Boulez and IRCAM. But, as I shortly demonstrate, by seeking a high and controversial public profile from the start of his career, Boulez has been eagerly complicit in this process.

Three phases of Boulez's career

I discuss Boulez's career in three major phases, to illustrate the combination of production and reproduction, the shifting national and international base, his political strategies and the character of his discourse. The first phase, from 1942 to the early '60's based both in Paris and in West Germany, was Boulez's most prolific and successful period as a composer. It also involved conducting and directing the *Domaine Musical*, and teaching and writing, including highly polemical texts. The second phase, from the early 60's to 1977, is characterised by two related developments: the expansion of Boulez's conducting career, both of orchestral work and opera, and an increasing number of international engagements, many of them highly prestigious. This was also, as we have seen, a period of estrangement and self-imposed 'exile' from the French musical and political scene. The third phase, from 1977 on, has been associated mainly with the directorship of IRCAM: a triumphant return to France to lead a major and innovative institution. But the triumph is not secure since from the early 70's a contradiction has become increasingly apparent: the rise of IRCAM has coincided with a decline in Boulez's composing activities.

France and Germany, polemic and composition: genealogy, ideology, and practice

The first phase in Boulez's career, from his arrival in Paris in 1942 at the age of 18 to the early 60's, includes Boulez's period as a student in Paris, his earliest job from 1946 to '56 as musical director of the Renaud-Barrault theatre company, and the start of the *Domaine Musical* from 1954. During the late 40's and early 50's in Paris as a student, Boulez is remembered for 'terrorist' actions and polemical articles through which he gained a reputation as an 'enfant terrible'. His biographer puts it (affectionately) thus: "Boulez's intransigence, his rages, the harsh yet accurately aimed abuse that he hurled at the heads of his unfortunate victims, made him famous and feared in Paris long before his music was known to more than a handful of initiates. 'He was against everything' Messiaen later recalled... (Boulez) carried revolt to the length of open war against what he regarded as the obscurantism of French musical life" (Heyworth 1986:7). In one significant incident, in 1944, he led a group of composition students in disrupting a concert

of Stravinsky's latest neo-classical works. Stravinsky, who had been blacklisted by the Nazis, was just then re-emerging and was considered a leading voice in French music and indeed worldwide. Boulez and his student group went on to examine and demolish other major figures of late romantic and modern music: Brahms, Tchaikovsky, Schoenberg, Berg, even his teacher Messiaen, whose 'Turangalila' symphony he called 'brothel music'. Boulez thus readily criticised even the figures from whom he learned most - Stravinsky, Schoenberg, Messiaen.

Boulez's most notorious polemic from this period, 'Schoenberg is Dead' (1951), written insensitively just after the composer's actual death, exemplifies the character of this discourse. He accuses Schoenberg of failing to carry through the revolution instigated with his serialist technique - the basis of musical modernism - by using old romantic forms. "For stereotyped clichés abound within Schoenberg, clichés typical of a romanticism at once ostentatious and outmoded" (Middleton 1978 Documents:61). But the article, at the same time as criticising Schoenberg for inconsistency and looking backwards, announces paradoxically that serialism alone is the way forward for music. "It is not devilry but only the most ordinary common sense which makes me say that, since the discoveries made by the Viennese, all composition other than twelve-tone [serialism] is useless" (ibid:61). The article laid the basis for what was to become the dominant '50's avant garde development, led by Boulez in Europe and Babbitt in the USA, out of the serialism of Schoenberg and his Second Viennese School. This was 'total serialism', which involved the application of serialist principles to the other dimensions of musical material - duration, timbre, intensity. The piece ends:

"...We must beware of looking upon Schoenberg as a kind of Moses, dying in sight of the promised land... It is time.. that we did away with misunderstandings and contradictions; and time to learn from his errors. Let us then, without any wish to provoke indignation, but also without shame or hypocrisy,.. admit the fact that SCHOENBERG IS DEAD" (ibid:61).

The strategy of the polemic is to denounce Schoenberg's failings while, at the same time, acknowledging him as the prophet: it thus establishes a genealogy for modern music, by decrying the 'sins of the father' and so prescribing the way forward for the next generation, to pursue the revolution with greater singlemindedness. In a companion piece from 1952, called 'Eventuellement...', Boulez again arrogantly pushed his message: "I assert that any musician who has not experienced.. the necessity for the dodecaphonic [serialist] language is useless. His whole work is irrelevant to the needs of his epoch" (Heyworth 1986:12). Having championed the work of Webern, Boulez led the way with total serialism, which he described thus: "I momentarily suppressed inheritance... and went on to see how one might construct a musical language from scratch" (ibid:13). In this way he defines a complete break within music: a crisis has occurred necessitating a new language. Heyworth says that "manuscript copies of Boulez's 'Eventuellement...' were handed around like a revolutionary manifesto" (ibid:14) among his group of young composers. Clearly, the combination of provocative language, absolute rigor, the appeal to revolutionary purity, the creation of a genealogy and of a sense of generational movement made Boulez's polemic and theory very effective in the uncertain post War

atmosphere.

Between 1954 and '67, Boulez was also conducting and directing the *Domaine Musical* in Paris. As we saw, through the circle of patrons, the audience of avant garde devotees and the regular 'salons', he gained entry to an exalted social, artistic and intellectual milieu. He thus moved from 'enfant terrible' to protege of the distinguished and wealthy - a rising young star. As we also saw, his *Domaine* became the arena of legitimation for new French composition. The concert programming thus complemented the polemic, by beginning to establish a canon of great works and a genealogy of the major modern composers. Meanwhile, from the late 40's to early '60's, Boulez also composed at his most consistently and successfully. Major works were the Second Piano Sonata (1950), 'Polyphonie X' (1951), the first book of 'Structures' (1952), 'Le Marteau sans Maitre' (1955), the Third Piano Sonata (1957), 'Deux Improvisations sur Mallarme' and 'Poesie pour Pouvoir' (1958), and 'Pli selon Pli' (1960).

During the same period, Boulez was venturing beyond France to circulate in the major european centres of the musical avant garde, the locus of which was West Germany. His links with the Germanic tradition had originated in his studies with Leibowitz, himself a pupil of the Second Viennese School. Boulez developed a close and lasting relationship with two important German centres, Donaueschingen / Baden Baden and Darmstadt, which between them premiered the majority of his works in the 1950's. His main German patron was Heinrich Strobel, director of the Sudwestfunk radio station in Baden Baden. Strobel and the Sudwestfunk also ran a yearly festival of new music in Donaueschingen, a showcase of the rising avant garde which premiered many of Stockhausen's works as well as Boulez's.

Strobel became Boulez's champion, and a close friend, through the following incident. Boulez's Parisian antics and invective had made him powerful musical enemies in France through the '50's. When in 1955 his piece 'Le Marteau Sans Maitre' was entered for the major international new music festival, the ISCM (International Society for Contemporary Music), the French jury refused to let it through to be played. The festival was that year held in Baden Baden and Strobel, as the host, deliberately flouted the French decision and had the piece played by his own orchestra. The French were furious, and were also made to look foolish when the piece was an enormous success and transformed Boulez over night into an international name. In 1959 Strobel offered Boulez a retainer in return for the right to first performance of his works, and Boulez moved to live temporarily in Baden Baden - an arrangement which eventually became permanent.

Darmstadt was the site, from 1946, for the yearly International Summer Courses for New Music, which became in the 50's and 60's the main meeting place of the composers of the new european avant garde. Early teachers included Leibowitz and Messiaen, while from '53 Stockhausen and from '55 Boulez also began to teach. Other major figures attending included Berio, Nono, Pousseur, and in 1958 Cage visited from the USA. Adorno was also a regular teacher during the 50's, so that Boulez and Adorno came to know each other at Darmstadt, perhaps accounting for the echoes of Adorno's thought and style in Boulez's own writing, including

his concern with sociological aspects of music. Adorno was at the time a major advocate of Schoenberg's serialism (set out in his Philosophy of Modern Music in 1948). Despite apparent differences, their views on Schoenberg and serialism are close; just as Boulez's polemic bears signs of Adorno's influence. Boulez wrote a poignant obituary for Adorno when he died in 1969 (Boulez 1986:517).

In part through his influence at Darmstadt, Boulez became the leading figure of the avant garde from the mid '50's, and produced in 1960 an influential series of lectures that were later published as his first book, Penser la Musique Aujourd'hui (1963). The Darmstadt courses became, and still are, a rallying point where young avant garde composers make their reputations. But they are particularly associated with the heyday of the late '50's when composers came from all over the world to learn the latest post serial developments from Boulez and others, amid an atmosphere of great optimism and unified endeavour that a new musical language - based on total serialism - could be achieved. Darmstadt therefore provided the basis of Boulez's interrelated theoretical and teaching work, both of which proved so influential in the '50's compositional environment. But as we have seen, Boulez was also deeply influenced by the Germanic musical, and philosophical, tradition as shown by his debts to Schoenberg, Adorno and Wagner. Thus, in the context of his volatile relations with French music, Germany became for Boulez a refuge, an alternative musical and intellectual home, and indeed an alternative power base that was to stand him in good stead through his political battles in France in the '60's. At the same time as sewing the seeds of his international career, Boulez put himself in a relatively invulnerable position in relation to French cultural politics. From a distance, he could afford to continue to act controversially. At a deeper level, the comprehensive range of Boulez's work across many interrelated domains in the 1950's - his polemical and theoretical writings, the teaching based on them, and the concert series and conducting that put into practice his views on the musical past and present - served to create an enormously powerful reproductive, supporting and legitimising, context for his own composition, and created the strategy for his subsequent career, including IRCAM.

International prestige: the conductor as culture hero

The second phase of Boulez's career, from the early 60's to 1977, was based mainly on a great increase in his activities as a conductor, and expanding international work and renown, with especially strong links to New York and London. The chronology involves a series of honours, musical and intellectual. In 1963, Boulez was visiting professor at Harvard University, while in 1976 he received the academic honour of a professorship at the *College de France*. As a conductor, Boulez rapidly made an international name through the 60's, culminating in the extraordinary achievement of being simultaneously the Chief Conductor of two of the world's leading orchestras - the BBC Symphony Orchestra and the New York Philharmonic Orchestra - between 1969 and 1977. This was an awkward, and a megalomaniac, arrangement. Boulez took on the BBCSO in '69 only to be sought out months later by the NYPO, and decided to divide up his time between them both. He became known in that period as a jet-setting international conductor. This was also the planning stage of IRCAM, since Pompidou and he had agreed on the IRCAM project in 1970.

In London, Boulez was championed by Sir William Glock, musical director of the BBC and the Proms. Boulez gained popularity amongst the young by organising some unconventional and informal events at the Roundhouse, the experimental London venue, at which he conducted chamber groups in recent avant garde works and afterwards discussed the music with the audience. He described the events, also expressing his broader sociological perspective, in 'Freeing Music' (1972) thus:

"Another thing I have tried is going out to meet the public, not confining music to the conventional concert halls. In London I have had regular audiences of a thousand at the Roundhouse, which normally attracts members of the theatrical avant garde and the National Film Society, a younger audience than is to be found at concerts... These people are much more interested in the theatre and the cinema than in music, and it is quite a challenge to undertake their conversion... By 1974... I hope that contacts of this kind will have become more permanent, that the orchestral players will have become used to a much wider repertoire, that contemporary music will have gained a much more broadly based public and that the distrust between professional players and the avant garde will have disappeared. This is vital if music is to survive" (Boulez 1986:483).

Yet Heyworth recalls these events as tense, didactic and inhibited:

"In practice, Boulez, the product of an authoritarian educational system... treats them as a means of imparting instruction" (Heyworth 1973:72).

Boulez was less well received in the United States, both by the American avant garde and by the New York public who were used to the flamboyance of his predecessor, Leonard Bernstein. He again began with a didactic approach: formal concerts centred on his personal canon of the Second Viennese School. But these were a disaster in the Philharmonic's subscription concerts, so he changed from the 'shock treatment' to a moderate exposure of unusual and less known, but still canonic, composers. He gave in to audience displeasure: new works were rarely performed. Composers were outraged by a 1969 interview in which Boulez was felt to have insulted many fronts of American new music. This ranged from the way out West Coasters, to the highest East Coast university spheres, whose philosophy was promoted by the Princeton based journal Perspectives of New Music, which Boulez ridiculed as having 'a cashier's point of view' (Heyworth 1986:37). In 1970, a group of well-known, mainly West Coast, young composers, the generation after Cage, wrote an open letter complaining that Boulez was not including any American composers in a forthcoming Californian festival. "They accused Boulez of 'imperialistic thinking', aimed at preserving 'the illusion of European superiority'" (ibid:37). Other significant aspects of the discursive conflicts between Boulez and the Americans become important inside IRCAM, and I sketch their history in Ch.9. But the quote indicates the conscious rivalries between the European and American factions of the musical avant garde.

As well as these posts, Boulez achieved one of the most prestigious opera conducting jobs: at Bayreuth, home of Wagner, and Mecca of the opera world. In 1966 he conducted 'Parsifal' there, 'Tristan' in Japan; and in 1976, he gained the supreme accolade of being invited by Wagner's

grandson to conduct the 'Ring' cycle there on the occasion of its hundredth anniversary. He was, by then, a personal friend of the Wagner family. And indeed, Boulez's similarities to Wagner are often remarked upon - one of the ways in which he is mythicised, by analogy with the great. Thus, from his friend, the leading music semiotician Nattiez: "Multiple activities, then - composer, essayist, lecturer, conductor... - Boulez has been them all... and always in the service of a single idea, his vision of the evolution of the language of music... First and foremost, then, he strikes us as a whole person. Few musicians except Wagner have made such a mark upon all aspects of musical, and para-musical, life" (Nattiez - Introduction, Boulez 1986:25). And from Heyworth, on IRCAM's high funding: "Not even Wagner succeeded in getting support on this scale from Ludwig II of Bavaria" (Heyworth 1986:39). As Nattiez says, Boulez's kinship with Wagner is strong, in two ways. They appear to share a concern rare among composers for changing the conditions of musical experience as a whole - the opera setting, the concert hall - and thus a vision of music on a grand scale, as a totality, including sociological dimensions. And musically, for Boulez, Wagner is a crucial progressive element in the Germanic musical tradition - from Beethoven, through Wagner, to the Second Viennese School - which is central to his genealogy of modern music.

Finally, just a couple of years after the Landowski / Malraux conflict, and despite having declared himself 'on strike' against French officialdom, this period saw Boulez take another controversial political stand on the French cultural scene, again for major stakes. Boulez took up the request in 1967 for him to collaborate with the director Vilar and the balletomane Bejart on another major reform: that of the Paris Opera, the highest state funded musical institution. By May '68 the drastic plans were ready. They involved, for example, ending all singers' contracts, and amalgamating two orchestras: not popular with musicians. Later in May '68, the revolutionary events caused De Gaulle to ask all leading intellectuals to publically lend support to his government. Instead, the left wing Vilar resigned and Boulez, according to Heyworth, "feeling that he had no alternative, followed Vilar's example and resigned" (Heyworth 1973:58). Despite a hiatus, by the 80's, after the start of IRCAM, Boulez became involved once again in directing the reform of the Opera, including plans for an expensive new opera house (*l'Opera de la Bastille*), and in other major developments, such as the new 'city of music' to be sited at La Villette. Yet Boulez remained most committed to IRCAM, which represents his most advanced hopes for music, as we will see.

IRCAM: the prodigal returns to take power

The third major phase of Boulez's career originated in President Pompidou's personal invitation in 1970 for him to plan and direct the music wing of Pompidou's new art museum, the CGP; and IRCAM was the result of Boulez's bargaining. Boulez's return with this spectacular success from self-styled international 'exile' - which had clearly increased his value back in France - had the air of the returning prodigal son, of the misunderstood and long-overdue heir. President Pompidou was apparently unhappy with the hostile relations between Boulez and French officialdom, and Boulez's virtual exile for a decade. Over dinner at the Elysee Palace, Pompidou offered Boulez a carte

blanche to design the new music research centre that he had spoken of in previous years, thus inviting him to take part in Pompidou's post-'68 reconstruction of French culture, and specifically his new museum. From 1970 to the institute's opening in 1977, Boulez was largely tied up with his London and New York conducting commitments. A skeleton administration, including the Artistic Director-to-be, WV, was left to co-ordinate the planning and construction; although some music and research work began in 1975 in the old building occupied by IRCAM. In 1976, the EIC was founded; and between January and December 1977 a massive series of 70 concerts called '*Passage du Vingtieme Siecle*' took place in venues all over Paris, directed by Boulez and WV. This extraordinary series celebrated the opening of the CGP, in January, and that of the new IRCAM building in August. It also put Boulez very much back in the Parisian public eye. In usual form, but on the biggest scale yet, Boulez aimed the series to be the definitive statement on modern music, including the early forebears and the best contemporary and young composers. IRCAM was thus launched with a major canonical and genealogical statement (see Ch.5).

Boulez's conducting career continues while he directs IRCAM, especially associated with the EIC (IRCAM's own orchestra). Yet it is notable that his compositional output declined greatly after the mid 60's, and since the start of IRCAM it has revolved almost exclusively around his masterwork '*Repons*'. Produced at and with the technology of IRCAM, '*Repons*' has been revised several times and successively premiered between 1981 and 1986. Boulez's compositional decline has led even sympathetic major critics to speculate that IRCAM represents for Boulez a misguided attempt to overcome, and a distraction from, his creative block. Heyworth reported in 1973: "...Those who maintain that (Boulez's) absorption in conducting is a means of escaping the creative problems that confront him suggest that this project [IRCAM] may be a further means of externalising his difficulties as a composer... Whether his research centre in Paris will provide the new creative impetus he plainly needs remains to be seen" (Heyworth 1973:74-5). It is notable that this sceptical ending to the main biographical essay on Boulez was cut out when it was recently reprinted in a hagiographic volume published in 1986 to commemorate Boulez's 60th birthday, as though '*Repons*' affirms Boulez's creativity. This indicates the weight that '*Repons*' bears not only in legitimising IRCAM, but also in rehabilitating Boulez's reputation as a composer: the two problems are linked.

The same queries were being raised by Boulez's critics about his conducting in the 70's, especially by the American avant garde. Heyworth wrote in his 1973 essay:

"Boulez's avant garde critics.. have dismissed him as a composer 'whose music has ceased to be relevant to these times.' They argue that he uses conducting as a means of establishing the historical pedigree of his own music, but cannot bring himself to face the fact that the rigorous serialism he once represented has come to a dead end - or, to put it more bluntly, that he conducts the works of the past because he can no longer see his way creatively into the future. Is it mere chance, his critics ask, that since his conducting gathered momentum he has produced no score of first-rate importance?" (ibid:72).

It is telling that this passage, challenging the legitimacy of Boulez's music and of his leading role, was also edited out of the 1986 reprint of Heyworth's biography. The later piece ends instead with a eulogy containing comparison between Boulez and two other "outstanding 20th century specimens" (Heyworth 1986:38) of composer-conductors, Strauss and Mahler; this is followed by the Wagner analogy, and by reference to IRCAM as a sign of the patronage of presidents Pompidou and Giscard d'Estaing for "France's greatest living musician" (ibid:38). Not only this eulogy, but even more the re-editing of the biographical essay between 1973 and 1986 so as to omit several previously critical passages, express well the increasingly heroic representation of Boulez.

The inflationary cycle of charisma, authority and power: myth and representation

Question: "How do you organise the time that you dedicate to composition? Do you work regular hours each day?"

Answer by Boulez: "No! Absolutely not!... To work fixed hours every day - I find that appalling. I like to work in an irregular, chancey way"

(Interview, Le Monde de la Musique n.24, June 1980, my transl.).

We have seen how, by combining daring and uncompromising interventions in French cultural politics with a prestigious international career, and by building his international stature until the French state could not afford not to use him, Boulez constructed the means for IRCAM. Here I examine the mythic and charismatic representation of Boulez, often as we have seen by analogy or association with the great, or by reference to his genius, grand designs or revolutionary spirit. In Ch.1 I discussed Bourdieu's reference to Weber in likening the artist to a charismatic leader, associated with 'youth' because also with prophecy, irregularity, iconoclasm and asceticism. In another article (1981), asking "Who creates the 'creator'?", Bourdieu notes that the charismatic cultural function 'spreads' contagiously outwards from the artist (and art work) to key mediators: to the critic, dealer or impresario who 'discovers' the talent, who has an 'unnerving' and 'intuitive' sense of gift; and who, in consecrating a talent, also confers charismatic authority on that talent, so bringing the artist into being or enabling them to function. We will see another strategy common amongst artistic communities: for established artists to patronise the talented, which critics then report, so legitimising the patronage. I would extend Bourdieu's analysis and argue that charisma thus tends to be passed around between interested parties who each have an investment: that it tends to escalate, to be an inflationary currency. This is something that emerges clearly from the inflation of authority in Boulez's history, in which charisma, authority and power have been mutually self-reinforcing.

We have seen the rhetorical strategy whereby Boulez is repeatedly compared to great composers such as Wagner, Mahler and Strauss. Another is to cite world class musicians as supporters of his talent. Heyworth - a major British music critic (of 'The Observer' and other quality papers) - reports Messiaen thus: "He has surpassed us all. For me,

Pierre Boulez is the greatest musician of his generation, perhaps of this half-century. I must say that he is a genius" (1973 a):45). Virgil Thompson, veteran American composer, "... saluted (Boulez) as 'Europe's finest composing ear and brain'" (ibid:45). Otto Klemperer, considered the greatest living conductor before his death, "hailed him as the outstanding conductor of his generation" (ibid:45). And finally Stravinsky, held to be one of the two masters of the first half of the century, and despite Boulez's student attack, "hailed Boulez as the founder of a new school of French music and as 'far and away the most intelligent conductor in orbit today'" (ibid: 45). Stravinsky and Boulez became close in the late 50's, the old man acting as Boulez's patron in the musical community. Yet their relations also had the opposite, deflationary effect, since by the end of Stravinsky's life the two had fallen out badly. Stravinsky then accused Boulez, in print, of being an 'arch-careerist', and called Boulez's piece 'Pli selon Pli' "pretty monotonous and monotonously pretty" (Heyworth 1986:23).

The 1986 volume Pierre Boulez: a Symposium, which contains the re-edited reprint of Heyworth's biography from which many of these reports come, also contains pieces - analyses and tributes - by major musical figures such as Sir William Glock, ex-head of BBC music and responsible for bringing Boulez to London, and Charles Rosen, American pianist and musicologist. The book's hagiographic spirit is conveyed by the back-cover blurb:

"There can hardly be a doubt that Pierre Boulez is one of the greatest musicians born in his century... a composer.. who has left 'a giant imprint on music in this second half of the century'. The editor, Sir William Glock, has long been active in promoting the Boulez phenomenon".

Glock himself speaks of "the memory of (Boulez's) crusade for contemporary music and of inspired performances that will remain unique in Britain's musical life in the twentieth century" (Glock 1986:238).

It is interesting to note that Heyworth's essay is not the only biography of Boulez. In 1977 a book came out with a suitably charismatic title - Boulez: Composer, Conductor, Enigma - by Joan Peyser, an American journalist. This book was notorious within IRCAM - it was suppressed, not spoken of, or if mentioned it caused irreverant giggles. Word had it that Boulez had banned it from the premises because he considered it profane and cheap. Apparently it contained scurrulous speculations on his personal life that Boulez could not countenance [PL, FA reports]. Boulez's personal life remains 'mysterious' even to the informed: an effectively charismatic tactic. The quote above illustrates another charismatic move: Boulez's self-representation of his musical work as irregular, chancey - anything other than following the fixed hours of mundane, non-artistic work. In Ch.4 it will become clear that the authority and charisma associated with Boulez in public life 'leak' into IRCAM; and I also show how Boulez is held overtly, and uniquely, in almost universal respect and awe within the institute.

I have indicated Boulez's increasingly direct links to the highest realms of power in France, to the glittering realms of the French social and cultural elites from the 50's on, and to international elites through his conducting career. On the other hand, we have also seen his involvement in international networks of the avant garde, and the

affirmation of his intellectual power by the *College de France*. I have suggested that where in other cultures and eras there may be a contradiction between rigorous intellectual and avant garde status, and mixing with the social and business elite and those in power, this is not necessarily so in France. This is due, as Bourdieu, Menger and the other material cited have shown, to the particular position of French intellectuals: antagonistic yet belonging to the dominant class, in a context where the acquisition of cultural capital is a mark of the very highest realms of social and economic power. We have also seen how, from roots in his youthful strategies for gaining charismatic authority, Boulez's power has increasingly been realised. The process of converting charisma into power is again self-reinforcing since recipients of power become themselves mythicised. And the myth of Boulez's power now has great momentum. Thus officials from the Direction of Music spoke, with mixed admiration, outrage and envy, of Boulez's 'total power' at and around IRCAM.

"He manipulates the Administrative Council, relations with the Direction of Music, the Ministry of Culture... Management by the IRCAM Council is just formal, a show: it has no real power to react or manage; nor the Direction of Music, nor the Ministry. It's all dependent on the personality of Boulez, who gives all confidence... He helps the relations of the musical sector with big politics, whether Socialist or Gaullist! He defends and promotes La Villette, the Bastille project [new state music projects].." (JPO / HG int, my transl.).

Another realm of charismatic rhetoric around Boulez, that we have already encountered, employs concepts of revolution, anarchism, vanguardism, heroism, prophecy - sometimes tinged with contradiction. Boulez himself toys constantly with this rhetoric. He sums up his mentor Wagner saying: "The revolutions that.. have the profoundest and most far-reaching results are revolutions in our mental categories, and Wagner initiated, once and for all, the irreversible processes of such a revolution" (Boulez 1986:277). Heyworth quotes Boulez saying: "You cannot make a revolution with anarchists... There I am three hundred per cent Leninist"; and later: "To be an effective revolutionary, you have to enter organisations and change them" (Heyworth 1973 b): 64 and 72). We will see below that Boulez rejects political anarchism; yet Nattiez takes the view that "Boulez is not a revolutionary so much as an 'orderly anarchist'.. a man who creates a disturbance in order to establish the truth in which he believes" (Nattiez 1986:21). Nattiez discusses Boulez's idea of history, quoting him thus:

"Any vision of history..implies..a sharpness of perception in judging the moment... It is the 'gift'.. to grasp the totality of the situation, to have an intuitive hold on the present and to apprehend its structure on a cosmic scale - that is what is demanded of any candidate who aspires to the title of 'seer'" (ibid:20).

Nattiez speaks of Boulez's self-professed "desire for immortality" (ibid:20); and above all of his obsession with discovering "the foundations of the new [musical] language" (ibid:20). Heyworth's biography reverts often to the revolutionary theme. Thus, of Boulez's critique of Schoenberg and Stravinsky:

"Could it be that the two arch-revolutionaries of pre-1914 music had both.. subsequently begun to play reactionary roles in the evolution of music? In 1946, that was in itself a revolutionary notion" (Heyworth

1973 a):58).

Boulez himself conveys a subtle understanding of historical process in other writings:

"History is divided into periods of evolution and periods of mutation, or, in other words, ... of conquest and ... of stabilisation... There is no longer any place in a demonstrably relative universe for the idea of progress as a kind of one-way movement" (Boulez 1986:36). This raises the complex and contradictory quality of Boulez's communications, in which the polemical and publicity pieces, which often take 'absolutist' and dogmatic stands, contrast with his more nuanced and reflexive theoretical writings.

Boulez establishes authority in his writings by his style, especially by the device of intertextuality: that is, by referencing other realms of culture, of discourse, other musicians, writers, thinkers. Some references are explicit, others implicit and must be drawn out of the text. A major aspect is the creation of a genealogy and canon of modern music, as we have seen, centring on the composers Wagner, Schoenberg, Stravinsky, Webern, and a few others. However, he also draws in other realms of discourse, as summarised by Nattiez: "He chose his own ancestors who, leaving the composers aside, include a number of painters (Cezanne, Klee, Kandinsky, Mondrian), and a great many writers (Baudelaire, Mallarme, Proust, Joyce, Kafka, Musil, Genet...)" (Nattiez 1986:21). I discuss shortly how Boulez cites the Bauhaus, a classic of modernist culture, as an inspiration behind IRCAM. These references - mostly to modernist greats from the various arts - are liberally sprinkled through his writings, creating an air of cultural breadth and command. But it is arguable that some of these colourful overt references are less directly influential on his thought than certain more implicit influences, which are not made clear and which I discuss shortly.

Nattiez also describes Boulez's media career: "As well as writing newspaper articles and giving interviews, Boulez also took part in a large number of broadcast or televised interviews" (Nattiez 1986:17). Boulez has thus sought the mixed career of 'serious intellectual' and 'media personality', with the attendant self-publicity, that Reader mentioned as a recent French intellectual strategy.

The influences and ideas behind IRCAM: Boulez's socio-musical vision

"Hagiographers seize like vultures on... those who have contributed most to forming the character of an age. In their hands mortals become heroes and heroes become saints or gods, gradually disappearing behind the clouds conjured up by the myth-makers. Any rash man who takes it into his head to search for the original facts is rejected as at best indiscreet; if not indecent and immoral. A composer's biography must be made to match his works, and Titans have no weaknesses. The unity of the man and his work is one of the most persistent articles of faith, with very few exceptions.

One of these exceptions, however, is Richard Wagner, who remains the subject of passionate controversy - not his music, but what he represents in the society of his age... The most striking thing about

Wagner's life has always been the inextricable confusion of ambition, ideology and achievement. The ambition proved illusory in the field in which he believed himself to be a master; the ideology rather confused compared with other philosophical movements of the time, notably Marx; the artistic achievement of such outstanding quality that it called in question and eventually overturned the existing language of music as well as of the opera. Wagner certainly saw himself as a prophet even more than an artist - a prophet who, having received illumination and grace, could claim the right to speak exuberantly and with authority on any matter whatsoever. The artist-redeemer possesses by intuition a universal knowledge, and his task in the world is to present solutions that have been revealed to him...

There have been endless accounts of how his existence was transformed - from one of destroying angel to that of court chamberlain, from utopian revolutionary to sour conservative... And yet it was the search for a total solution that was the real passion of Wagner's whole existence and provided the justification of even its most ambiguous and unacceptable aspects...

The worldwide response that Wagner proposed has remained isolated and individual, lost in the general context in which there has been no fundamental change... His plans were never to be realised because he died too soon to realise them. German art was never to know its first school, and Bayreuth was soon to become a blindly conservative rather than an exploratory institution"

(All from Boulez 1986: 'Richard Wagner: the Man and the Works': 223-229).

Boulez's ironic and perceptive comments on Wagner's charisma and career resonate uncannily with the character and processes of his own life, of his own grand and holistic plans. Like Wagner, he proposes with IRCAM a 'total solution' in institutional form to the problems of contemporary music. His account of the fate of Bayreuth - Wagner's megalomaniac institution, his IRCAM - may be Boulez's prophecy of the eventual, or even appropriate, fate of IRCAM. In Appendix 5 I reviewed the broader national forces and interests behind the appearance of IRCAM; and above I have analysed the processes whereby Boulez gained cultural authority and charisma, resulting in the state's investment of power in him. In this final section, I analyse Boulez's ideas and the influences behind IRCAM. I show that Boulez's complex discourse contains major unresolved tensions. I then argue that while certain aspects of Boulez's discourse, particularly his musical philosophy, are completely congruent with the broader processes of rationalisation and centralisation that we have seen behind the emergence and character of IRCAM, certain of his 'sociological' and political views are incongruent. We can thus discern the limits and contours of Boulez's ideology, and the contradictions, and absences, that may be inherent to IRCAM.

Boulez reveals his ideas for IRCAM in writings from the late '60' on; but examining his written oeuvre as a whole shows the longer development of the themes behind IRCAM.

Rationalisation of the musical language

From the late '50's and early '60's, at the time that he was leading the

way with total serialism, Boulez stresses the new kind of rationalisation of the musical system that it makes possible. He says: "It is my belief that our generation will be... devoted to the expanding of techniques, the generalising of methods and the rationalising of the procedures of composing or, in other words, to synthesising the great creative currents that have made their appearance since the end of the last century" (Boulez 1986:177, from 1958).

He contrasts this era with the previous rationality underlying tonality in an interesting way:

"The rational appeal of tonality.. and the new possibility of generalising - even standardising - musical relationships was essential to the further development of the art... The serial principle, which is that of a hierarchy established anew in each work, and not a pre-existing system like that of tonality, has given the composer the ability to create musical structures that are constantly evolving... It is worth observing.. that scientific thinking has evolved in exactly the same way" (ibid:37, from 1961).

We see, then, Boulez's stress on new forms of rationalisation and standardisation at the deep level of musical structure, derived from serialism. To this is added an Adornian notion of the necessity of discovering the immanent laws of musical development:

"For the fundamental question we must ask ourselves is where the true tradition is to be found. As Theodor Adorno wisely said, there is more tradition in.. Webern's opus 9 than.. in Prokofiev's 'Classical Symphony' - by which he meant that reproducing a model from the past is meaningless compared with drawing the consequences implicit in the musical language" (ibid:39).

With Adorno, then, Boulez chides all backward looking neo-classicism, and holds an avant gardist view that innovation necessitates refusal of the immediate gratification of the general audience:

"It is in individuals who were in practice refused general admiration, and.. even any corresponding social recognition, that we find the true portrait, or model, of an epoch" (ibid:38).

Already, there is a quasi-positivist stress on the interface of music and science, by analogy with structural linguistics:

"Music is a science as much as an art. How is it possible to study the history of music except, primarily and essentially, through the evolution of its forms, its morphology, and its syntax?... It is by this same study of grammatical features that we can date a musical composition" (ibid:33-34).

Despite his disavowal of progressive evolutionism, Boulez conceives of the art music tradition as evolving in that way. Yet in the very same piece, and in lectures from the same time, Boulez complicates and contradicts the spirit of his own position, embracing historical and cultural relativism. "We should be wary of talking about the 'eternity' or 'supremacy' of any of our musical laws. Their value is relative" (ibid:39). And in a Darmstadt lecture from 1960, he scorns -

"...what is called the 'mathematical' - and is in fact the 'para-scientific' - mania.. (which) gives the illusion of an exact, irrefutable science based on precise facts: it appears to be presenting

objective facts with the maximum of authority. This is a return to the medieval concept of music as a science demanding a scientific, rational approach,... formed on models existing in other disciplines based on the exact sciences. What a pious illusion!" (ibid:73).

These 'number fanatics' seek a "form of rational reassurance" (ibid:73).

Ultimately, he makes a fragile compromise by referring to the relationship between the musical universe and the rational, scientific universe as one of analogy. He states:

"The argument that music is sterilised if it is 'reduced to a formal self-sufficient system'.. is invalid... I have never established any direct relationship between music and mathematics, only simple relations of comparison. Because mathematics is the science with the most developed methodology at the present time.. I have tried to establish an analogy" (ibid:98).

This is a subtle and uneasy peace. Boulez never explains how he distinguishes musical discourse from those which he draws upon to structure it by analogy - a problem concerning theoretical discourses around music discussed in Chapter 1. In fact, rationalism and scientism recur constantly in his own discourse.

Technology and sociology

By the late '60's, in Boulez's first mention of the IRCAM idea in a speech delivered on May 13th 1968 at the height of the revolutionary May Events, his rationalism is transmuted into a more mediated concern with technology as well as related scientific research. He calls for a renewal of musical materials - of the sound-producing infrastructure - to match that of the new post-tonal musical system and new musical forms: for the two to develop together. Specifically, he suggests research on three interrelated fronts: on new, particularly microtonal, intervals and scales, beyond the outdated tempered semitones relevant to tonality; on new instruments, since the current range long since ceased to evolve and are now outdated, and which can produce the new scales; and on new sounds via electronic music, which may enable both previous developments. In passing, he scorns the 'take-over' of the electro-acoustic world by a "curiosity-shop aesthetics, this bastard descendant of a dead Surrealism" (ibid:456), implying the school of *musique concrete* at the GRM.

In this and another major article called 'Technology and the Composer' (Boulez 1977), often taken as manifestos for IRCAM, he outlines his reasons for this turn to technology which, as we have seen, came long after many other composers and schools had embraced electro-acoustic media. It is embedded in a broader historical analysis of the malaise of contemporary music. Boulez sees two crucial problems: the need to transcend negation as the basis of the musical language, and to overcome the predominant historicism of the musical professions and concert life, out of which he pursues sociological issues.

In the 1968 article, Boulez describes the 50's and 60's as a period of laying the foundations of the new musical language, from roots in serialism:

"Our chief concern was the discovery of the grammar and the form

necessary for.. a solid and reliable language, one not merely linked to.. vague speculations... What we were looking for was not a fashion to be worn for a single season.. but a real language and long-term solutions of formal and linguistic problems".

But this involved "the phenomenon of negation. If you do not negate,.. if you do not question (the) heritage and adopt an attitude of fundamental doubt towards all accepted values, well!, you will never get any further" (Boulez 1986:446). From this era of negation, the '68 article calls for a fundamental shift to a period of synthesis (ibid:463) drawing on the many currents of the past decades: musical, technological and scientific. Boulez's use of the term 'synthesis' is significant, with its other meaning - electronic sound production - central to his vision.

Through these articles run Boulez's more sociological and historical analyses, concerned with what he sees as the outdated and moribund conditions of the musical scene. In the 1977 article he criticises the historicism and conservatism embodied in the 'museum' culture of concert life. He argues that all the major musical institutions - concert and opera halls and events, the orchestra, as well as instruments themselves - have ceased to evolve and remain stuck in outdated modes which alienate the audience. Boulez's sociological ideas centre on related questions of the audience, and of architecture. He repeatedly denounces the backward looking design of concert halls, and sees them as inducing ritualistic and reified experience. "Hitherto music has been 'contemplated' like a picture. Now.. concert halls.. must include adaptable features" (ibid:484). He calls for new kinds of 'flexible' concert hall and programming, for visual interest and cross-media events that attract the young. For example, he criticises the recent Berlin Philharmonic Hall for only tampering with these conditions:

"The whole central conception remains unaltered - the conception of music as an object of 'worship'... Each individual worships in his corner and the architecture of the hall makes any participation impossible" (ibid:451).

The selective, and implicit, influence of Adorno and Benjamin are not far away here, and in much of his sociological analysis. Thus, as with Benjamin's critique of the aura of the unique artwork, Boulez states:

"Our concert halls are a completely aberrant phenomenon. They were built.. for nineteenth century performances... You watch someone playing, you watch without taking any part; you are contemplating the masterpiece. This conception is quite inapplicable to contemporary music (since) the 'masterpiece' no longer exists as a form" (ibid:450).

Where Benjamin saw the 'end of the aura' as a function of mass reproduction in popular media, such as film, Boulez applies it here to art music and so distorts Benjamin's analysis by implying that live conditions alone, rather than the mass technological form with its profound effects on the content and experience of the work, dictate reception.

On the audience, Boulez takes two perspectives. First, and again following Benjamin and the influence of post structuralism (especially Barthes), he stresses issues of perception. On the one hand this is a

call for research into the limits and nature of musical perception, which becomes the IRCAM commitment to psychoacoustics. On the other, Boulez states as a classic article of post structuralist faith: "Contemporary music in fact demands the intelligent participation of the audience, which is 'making' the work at the same time as the author... the work (has) multiple meanings that the listener can discover for himself.. (by assuming) an active role" (ibid:462).

Second, having blamed the conservative and dated character of musical institutions for the unpopularity of new music, Boulez has contradictory reflections on the small size and elite nature of the audience. At the time of the *Domaine Musical*, he defends its small but growing audience against accusations of 'cliqueishness' and snobbery, arguing that they represent the farsighted and that "your numbers, my dear snobs, increase year by year" (ibid:432). By '68, he states that "real cliqueishness, for me, consists in being content with the approval of a small group" (ibid:452) and, implying that the aim is to build a reasonable audience, says that one must 'set out in search of a public'. However, at IRCAM Boulez was cited constantly as being against the mass audience ('*la grande public*'), and indeed, as we will see, appears by definition to distrust the integrity of any events that draws large audiences.

We can see a final telling element of Boulez's sociological aesthetics, complementing these views on the audience, in later interviews. It becomes clear that Boulez equates large audiences with commerciality, with easy listening and aesthetic compromise. Thus, criticising the 'supermarket aesthetic' of pluralism:

"I'm always astonished that composers speak in terms of quantity, ie 'music is valid if it has more than two thousand people listening to it'. For me, that's no criterion of validity" (Boulez 1984:15). He adds that simple pleasure, entertainment and enjoyment, are nothing to do with value and artistic progress: "What remains in history - entertainment music or music that is more demanding.. ?" (Boulez 1984:15).

Similarly, in a 1980 interview, the interviewer says to Boulez: "There is today a public that is less and less concerned with making a hierarchy between different musics, as you seem to do"; and Boulez answers:

"Me? I make no hierarchies. I simply say that there are shortcomings in certain musics and that 'enjoyment' is not a sufficient criterion: one can derive pleasure, but that doesn't mean that something has value... But I continue to think that to bring together people who have divergent views, that can be productive" (Boulez: Le Monde de la Musique n.24, 1980 my transl.).

Boulez describes the composer's dilemma as a deceptively naive choice:

"The opposition, then, is really that of being understood or not being understood by the mass, being complex or not complex, having a vocabulary that is really very easy or one that is less easy to grasp" (ibid:14).

All of this echoes with the Adornian perspective on the relation between commerce and culture, which Boulez states bluntly thus:

"The economy is there to remind us, in case we get lost in this bland utopia: there are musics which bring in money and exist for

commercial profit; there are musics that cost something, whose very concept has nothing to do with profit. No liberalism will erase this distinction" (Boulez/Foucault 1985:8).

Thus, autonomous music will, by definition, disdain the mass audience and commercial success; and by implication, autonomous research into the future of music must be independent of commercial interest.

It is clear that Boulez's sociology, concerned with halls and ritual, combining aspects of the Frankfurt school and of post structuralism, evades consideration of the responsibility of his 'autonomous' aesthetic choices for the malaise that he describes with such concern. His sociology is thus highly circumscribed. Beyond their abstract 'active participation', Boulez is not interested in the feedback of an audience's actual attendance; just as he denies absolutely the legitimacy and long-term value of any commercial development. There could be no clearer expression of the antagonism for the values of the market, of economic capital, by which the domain of cultural capital defines itself. But Boulez's perspective also embodies another of Bourdieu's themes. His very 'disinterestedness', his stress on the value of music residing by definition in it being 'demanding', 'not understood by the mass', 'complex', 'having a vocabulary that is.. less easy to grasp': this all speaks to Bourdieu's analysis (Ch.1) of the refined and educated art perception that operates amongst the bourgeoisie, and that distinguishes their 'culture' from the immediately pleasurable experience of the lower classes. Boulez's position therefore epitomises an elitist cultural 'distinction'; yet this is in tension with his professed desire to create a larger audience. This, at least, makes his apparent commitment to pedagogy - as a strategy to broaden the audience - more understandable.

IRCAM: collaboration, vanguard, institution

The existence of IRCAM is predicated on the same perspective. Boulez argues that music technology has so far been researched and developed in small, scattered ad hoc situations; or by technicians and scientists in non-musical environments such as Bell Telephone Labs, where computer music was developed, ignorant of musical needs. He speaks of sound technologies as having developed autonomously, without reference to musical issues, through the "inexorable law of movement.. under the ceaseless pressure of the market... Irrational necessity preceded aesthetic reflection" (Boulez 1977:8). Thus the technology has developed according to the demands of the market - for pop music and commercial technologies - rather than the long-term needs of future music.

Instead, in a 1970 article called 'The Bauhaus Model' (ibid: ch.54), Boulez outlines IRCAM's form, citing the Bauhaus as his ideological and institutional model. The Bauhaus was an institute founded in Weimar in 1919 by the architect Gropius, and is known as one of the most radical modernist cultural experiments of the century. It fused together the fine art and applied art schools into a collaborative workshop, inspired by the medieval guild workshops. The idea was to create an atmosphere of invention and experiment, a 'laboratory' where students and teachers would stimulate each other. Gropius's ideological aim was to overcome the 'arrogant class distinctions' separating craftsmen/technicians and

artists. The school's practice involved the design of all levels of the 'machine for living in'. By 1923, the school's second phase, Gropius was adopting an unpoliticised position. Bauhaus archaic romanticism gave way to 'Amerikanismus': an ethos centred on "progress, the marvels of technology and invention, the urban environment" (Willett 1978:81, quote from Schlemmer). The school's new philosophy was summed up by the slogan 'Art and Technology - a new unity'. Thus, originally inspired by socialism, but increasingly de-politicised in the volatile context of Weimar, the undertaking recalls the Saint Simonian doctrine of bringing the arts and sciences together in the service of applied industry. It came under increasing political attack for not showing enough results, and was eventually closed down by the new Nazi government in 1933, accused of 'decadence' and 'Bolshevism' (Whitford 1984, Willett 1978, Gay 1968 98-101).

For Boulez, the Bauhaus "exercised an enormous power of renewal in all the visual arts, starting of course with painting, since two outstanding painters - Klee and Kandinsky - attached themselves for a while to the institution and were joined by others of quite unusual gifts... We are still living today.. on ideas systematically explored by a small group working in an institute in which research was carried on for its own sake" (Boulez 1986:464). We will see however that other aspects of the Bauhaus, less intended by Boulez - American influence, depoliticisation, pressure on results - also pervade IRCAM.

Boulez outlines his own desire for such a specialised music institution, searching for 'radical solutions', with the freedom to consider problems "from an unprejudiced point of view and (where) intellectual necessity takes priority over economic considerations" (ibid:465). It would address sociological aspects of music - audiences, concert organisation - as well as the redesign of instruments and new sound production. He argues that such an institute must be -

"..quite independent of the official powers that hold music anchored.. to routine... (An) institute of this kind should enjoy a total autonomy and a very flexible internal structure despite its many external links and ramifications. With no immediate obligations it should be able to manifest a true disinterestedness and pursue objectives unattainable by any organisation too deeply engaged in 'mundane' matters" (ibid:466).

He adds as an aside that it may require working co-operatively with the commercial firms that actually produce electronics, for materials. Thus 'disinterested' autonomy is clearly set up in opposition to the 'mundane' interests of commerce.

In later writings, Boulez mentions other models for IRCAM, such as the American universities developing computer music at which there exists a "permanent alliance between musicians and scientists"; and the German Max Planck scientific institutes (ibid:484, from 1972). In fact, he had been approached by the Max Planck organisation as early as 1966 to set up a musical research institute. The link is significant in that the Max Planck centres are set up around individual leading scientists, last several years under their direction, and are disbanded once the director retires or dies. They are therefore imbued with a charismatic ideology, here of scientific leadership and research - an ideology that we will see is also of relevance to IRCAM culture.

In setting up a "general school or laboratory" (ibid:455) Boulez refers repeatedly to the necessity for teamwork or collaboration between researchers, musical and scientific. He argues that it cannot be based on small, isolated 'ghettoes' but requires 'co-ordination between the experts, the inventors and the musicians', a coming together of scientists and musicians. "General solutions must be found with the help of technicians who have studied these complex questions under the direction of composers" (ibid:458). The heart of Boulez's vision of IRCAM, then, is the "utopian marriage of fire and water" (Boulez 1977:10) between music and science, art and technology, founded on interdisciplinary collaboration between musicians and scientists. It hinges on the unification and integration of binaries - music / science, research / invention, individual / collective - through a new practice, a collaborative division of labour involving "genuine dialectic" (ibid:10). This causes Nattiez to remark that "the fundamental characteristic of Boulez's thinking.. (is) the binary principle... Like every dialectician, Boulez is able to transcend his own contrasts" (ibid:27). The dialogue, Boulez argues, must be aimed at long-term goals, independent of immediate needs, official pleasure and market forces.

By this notion of collaboration, inspired by the Bauhaus, Boulez implies a democratic and egalitarian sharing of skills and ideas. This is the crux of his social vision of the institute's internal work relations, and around it he scatters utopian and politicised rhetoric. The 1977 'manifesto' for example, quoted at the start of Chapter 1, speaks of 'dialectic', 'collective', 'infinite possibilities', 'utopian'. Boulez writes of transcending "humdrum, particular solutions which somehow remain the composer's private property. What is absolutely necessary is that we should move towards global, generalisable solutions". The aim, he says, is "to envision the distant future, to imagine less personal, and thus broader, solutions", and stresses that "long-term preparation of research and..instantaneous discovery must not be mutually exclusive" (ibid:11). It must be achieved by a "continual exchange between giving and receiving.. (a) permanent dialogue" (ibid:14). "The effort will either be collective or it will not be at all" (ibid:14). The rhetoric thus resonates with various political languages - socialist, vanguardist, Leninist, Trotskyist. It appears to call for an end to the notion of private property and individual labour in creative work, for internationalism, and for IRCAM to be a vanguard of long-term, future-oriented research. IRCAM thus presents itself through these pieces, reprinted as publicity, in language broadly reminiscent of revolutionary rhetoric. Nattiez, in support of this self-conscious vanguardism, comments on the significance of the fact that Boulez's first public mention of IRCAM, on May 13th '68, was also the day of major demonstrations against de Gaulle's government.

However, beyond the rhetoric, Boulez's politics are complex: it is clear only that he is in no simple way aligned. He was a Communist in his youth, which he recalled cynically to Heyworth as a "substitute for church-going" (1973 b):58). Disenchanted in 1948 by the excesses of Stalinism, he has been non-aligned since and rejects the notion of 'engaged' art, although Heyworth says that he "still sees the world in Marxist-Leninist terms" (ibid:58). Boulez signed a manifesto in 1960

against the Algerian war; but on the May '68 events he took a contradictory position. He was sceptical of the students' chaotic anarchism; yet he resigned from his presidency of the Musicians' Union when its parent organisation, the Communist CGT, came out against the revolution. He was clearly against the repressive aspects of De Gaulle's government; and after the government had regained order, he signed a now infamous Left manifesto of young intellectuals published in the journal 'Tel Quel' "deploring the notion of 'spontaneous' revolution and saluting Marxist-Leninism as the 'the only valid revolutionary theory of our time'" (ibid:58). On the question of being a political artist, Boulez has commented "I can't change society. I haven't the technique for it" (ibid:58); while he also argues, aptly for the IRCAM project, that "to be an effective revolutionary, you have to enter organisations and change them" (ibid:72). His politics, then, appear part Marxist-Leninist, although unengaged, but more deeply influenced by the climate of German critical theory and cultural work that he must have encountered there from the 1950's, particularly through Adorno.

The ideas and influences behind Boulez's plan for IRCAM, then, are complex and raise contradictions. We have cause to ask, for example, how he reconciles his vanguardist views and call for egalitarian collaboration with the hierarchical public bureaucracy that was set up under his direction; or his desire to avoid official control with directing a large state institution. These are only some of the disjunctures between Boulez's vision and the actual institution that require empirical investigation.

Appendix 7 Overview of the history of computer music before IRCAM

This Appendix provides a brief overview of major developments in the history and state of computer music prior to IRCAM. The development of computer music over the past three decades has largely been based in the United States, fuelled by its technological hegemony; until, in the last decade, the Japanese have begun to have a strong presence, particularly in regard to small digital music technologies.

The basis of all digital processing of sound was provided by the telecommunications researcher Shannon working at Bell Labs in 1948. He produced a mathematical equation - the sampling theorem - that enabled any sound waveform to be described as a sequence of numbers that correspond to the value of the waveform's amplitude at a rate determined by the wave's bandwidth, or range of component frequencies. For example, one second of sound with a bandwidth of 20,000 hertz can be exactly digitally recorded or reproduced by a sequence of 40,000 numbers, or 'samples', that correspond to evenly spaced values of the sound's amplitude during that second. Theoretically, the computer can therefore process numerical information corresponding to any imaginable sound: as one IRCAM director put it to me, introducing the technology of computer music, "anything becomes possible!". This sampling method underlies all subsequent digital recording, generation and transformation of sound.

As we saw in Ch.2, computer music as a field also originated in work on the computer processing of sound at Bell Labs, carried out in the early 50's by Max Mathews - later IRCAM's first Scientific Director - and co-researchers. It arose from research that used the computer as a sound-analysing and sound-producing machine in the investigation of efficient transmission of speech by telephone. Mathews, an enthusiastic amateur violinist with a deep interest in the technological possibilities of music, realised that this work could also be applied to music, and began to study the production of musical sounds.

Mathews, from 1958, pioneered direct digital synthesis, in which the computer produces numerical waveform samples which are then converted into electronic signals, which in turn drive a loudspeaker, thereby producing sounds. This involved the development of crucial computer music technologies called digital-to-analog converters (DAC's): machines that translate digital information into analog electronic signals. The reverse process is accomplished by analog-to-digital converters (ADC's), which convert acoustic sounds, via their analog electronic recording, into digital information: a set of numerical samples representing the sounds, which can then be processed by the computer.

The late '50's and early '60's saw researchers trying to synthesise simple sound waveforms by computing the patterns of numbers that they believed adequately represented them. But this work was generally disappointing, and the results were certainly unmusical. This was due to two kinds of problems.

First, there were technical problems due to the inherent limitations of size of memory and speed of computation of the mainframe computers of the period. Direct digital synthesis is extremely demanding of the

computer, since for each second of sound tens of thousands of numbers must be produced. The mainframes were stretched by the amount of digital information they were being used to process, and this meant both that their numerical representation of complex waveforms was limited, and also that they worked very slowly. Researchers have a term - the 'turn around time' - for the ratio between the time needed by the computer to produce the sound samples and the actual duration of the sound so synthesised. The IRCAM Pedagogy director, RIG, described with nostalgia how back in the early days of computer music he would take his batch of punched computer cards to the University computer centre and wait a week for them to be processed so as to hear back the sounds encoded on them. But even by the late '70's, turn around times of well over 50 to 1 were common, so that each time a composer wanted to re-synthesise one minute of sound it would take an hour. The implications of these lengthy time delays were twofold. Computer music did not yield to empirical musical work and efficient experimentation with sound, and so was resistant to improvement. And nor could it be used in live performance. It remained an acoustics laboratory or computer studio pastime, requiring access to centralised technological facilities, and extremely demanding of computer memory and time resources. Although there were improvements, at IRCAM in 1984 these problems still remained, and for the most complex synthesis it could take a few hours to synthesise just 20 seconds of sound. One of the central battles in computer music, then, has been to shorten this time lapse so as to enable a more immediate or 'realtime' way of working with synthesis, allowing faster feedback and so a more direct or empirical way of working.

The second, related kind of problem in early computer music was conceptual; and it raises a unique and central feature of the computer in relation to music: its capacity to produce far more accurate scientific models and acoustic analyses of sound than hitherto. In trying to synthesise musical timbres by following the existing acoustic analyses, researchers found that these analyses were woefully inadequate and even plain wrong. The difficulties they experienced led to increased acoustic and psychoacoustic research utilising the computer on a more complete understanding of musical timbre; and we will see later that in the last decades psychoacoustics has become particularly important to computer music. As an example, previous analyses of acoustic instrumental timbres had focused on only the middle of the sound waveform. This part of the sound approaches a steady or stable state which is relatively easy to analyse and describe. But psychoacoustic research showed that far more important than the steady state in simulating perceptually adequate representations of timbre are the beginning and end parts of the sound, called respectively the 'attack' and 'decay'.

The doctoral work of the French researcher-composer Risset at Bell Labs, later IRCAM's first Computer director, made a significant contribution to the improved understanding of timbre by computer-aided analysis. He wrote a major paper while at Bell in 1965 ('Computer study of trumpet tones') which analysed the acoustics of, and then showed how to synthesise, a good trumpet timbre. He demonstrated the importance of the attack and decay - the amplitude 'envelope' - in producing a good simulation. But he added another major insight: he showed that within the frequency spectrum of a timbre, which consists of several partials

or harmonics above the main (fundamental) frequency, the partials do not have the same envelope - ie their amplitudes do not evolve in time in the same way. Timbre is characterised above all by the way that each important partial evolves independently, and so by their complex covariance in time. Thus adequate synthesis of organic musical timbre requires the specification of the independent evolution of each major component partial - necessitating even more complex information.

Risset's research depended on a new method based on the computer analysis of a sound by breaking it down into its individual partials, and discovering their individual envelopes. The enormous amount of information produced is then sifted by the researcher for what is perceptually most important. The researcher then constructs a hypothesis that gives a simplified physical description of the sound, and synthesises the sound by computer according to that hypothesis so as to test its accuracy - ie how similar the synthesised sound is to the original sound. This method is still used, and it shows the interdependence of the refined acoustic and psychoacoustic analyses enabled by the computer, with increasingly sophisticated computer sound synthesis. Risset's work thus exemplifies the dialectical relationship whereby the computer can first be used for acoustic analysis, thereby improving the researcher's knowledge; and then for synthesis based on this knowledge, putting it into practice, which in turn feeds back information on the original analysis. It is this feedback process between analysis and synthesis or production that in theory makes the computer the most sophisticated tool available. And it underlies the fundamental tenet of the discourse of 'music research' that scientific analysis of music/sound enhanced by the computer, and the problems of contemporary and future composition, are inextricably linked.

The crucial early development in computer music was the development of specialised software. Mathews at Bell, during the late 50's and early 60's, wrote a series of computer music synthesis programs culminating in a program called 'Music V', which became the basis of his pioneering tutorial book The Technology of Computer Music (1969). During the 70's and early '80's, the field stabilised around a group of related synthesis programs that were descendants of 'Music V'. This generation of software - programs with names like 'Music X', 'Music 360' etc - came out of the American computer music studios, were designed to run on various mainframes, and are known collectively as 'patch languages'. These programs provide a way to instruct the computer to generate the numerical samples representing a wide variety of desired sounds; and in their time they were considered a breakthrough allowing an elegant and shorthand input of data by the user. But in order to work, as I show later, the patch programs still require the user to specify rigorously and exhaustively the physical structure of the sound desired: to build it up from scratch using acoustical information. The programs provide only low level building blocks for sound synthesis, rather than higher level, musically appropriate or ready-made controls. Originating in Mathews' work at Bell Labs on 'Music V', some patch languages had an affinity with the UNIX operating system which had also been developed at Bell, and which as we have seen became established in the early '80's in combination with the DEC VAX minicomputers as the industry standard. The patch languages therefore remained the main form of digital sound synthesis into the '80's. The '84 IRCAM stage, for example, was based on

another 'Music V' descended patch program called 'Cmusic', a teaching program produced by the CARL studio at UCSD.

The other most significant development within early computer music, touched on in Ch.2, was the invention of a technique for digital synthesis by frequency modulation (FM) by John Chowning, the head of Stanford's computer music studio. FM synthesis was far more efficient in generating interesting and rich sounding timbres than the other techniques. In additive synthesis, for example, each partial is generated separately, and each separate evolution must be controlled, so that a great deal of computation is required. It is thus flexible to control, but very slow and expensive of computer time. Unlike additive synthesis, FM cannot produce any arbitrarily specified timbre or frequency spectrum. But Chowning and others have shown that FM can produce many rich musical timbres efficiently and economically by the technique of controlling complex interactions between two waveforms, using far less computing power, and far closer to realtime. As mentioned earlier, Chowning's FM technique became the basis of the small commercial realtime synthesizers that appeared from the early '80's.

Overall, this first phase of computer music was in large part propelled by the desire to transcend the limits and problems of analog electronic music that had become apparent since its rise in the 1950's. That period, which I discuss more fully in Ch.9, had seen two major factions within electronic music, based on two very different techniques and with two aesthetics. On the one hand, French *musique concrete* took any recorded sound as the basis for sound collage using tape recording technologies: extremely rich sound materials that could, however, only be manipulated in rudimentary ways. While the German *Elektronische Musik*, using only electronic generated sounds which were often dull and with little variety, afforded greater control. This play-off between richness of sound and complexity of control appeared irresolvable until computer music technology promised an integration that could overcome it. In fact, hybrid technologies - using both tape and electronic synthesis - could and did provide more satisfactory electronic music. But it is striking that throughout the history of these fields, actors have often polemically rejected mixed technologies, preferring to adopt purist stances and to proselytise for one kind or another. IRCAM retains such an ideology in the tendency to champion pure digital synthesis and in the process to reject not only the previous generation of electronic media as outdated, limited and irrelevant, but also the potential of mixing analog with digital techniques: issues that I discuss in Ch.8.

Computer music promised to allow not only a better synthesis of complex and interesting sounds than electronic music, because of its potential to simulate 'any imaginable sound'; but also to provide new, high-level means of controlling sound structure: from the evolution of individual sounds, to their grouping in 'phrases', to the overall structure of a composition. However, I show below that if we look at the actual development of computer music before IRCAM, we see that as well as the potential gains some glaring losses or regressions had occurred. This becomes particularly clear by comparing the patch language form of synthesis with analog techniques.

The concept of a 'patch' comes in fact from the previous generation of

analog synthesisers. These involved a series of electronic devices (eg voltage-controlled oscillators (VCO's) to generate simple waveforms, filters, envelope shapers) that the user connected up with so-called 'patch cords', thereby manipulating their interconnections to produce and modify sounds. The computer patch languages work by digitally simulating certain of these analog techniques. Analog synthesiser players, having set up the electronic network of devices, can physically manipulate them and experiment with their interrelation in realtime (using knobs, handles, faders (potentiometers) etc) thereby producing immediate sonic results; so they obtain direct empirical feedback, by hearing the sounds immediately as they are produced and changed by manual (or gestural) manipulation of the controls.

By contrast; the computer musician using digital patch programs has a more laborious task. He has first to encode complete acoustic instructions about the desired sound into a computer file called the 'score' in advance of the synthesis; so that he must predict or foresee the desired sound in that description. After a delay of some minutes or hours while the digital samples are generated, the sound is played back through loudspeakers. Once heard, if the sounds are not as wanted, the user has to stop, re-conceptualise and re-hypothesise the acoustic instructions, and re-write the score file accordingly. The computer then re-synthesises, again with a delay, and so the process continues. Thus each time the user wants to alter the parameters of a sound, to try a different approach, he must re-write the relevant file entry (eg a frequency, an amplitude, a duration) and then wait while the computer program re-processes the entire file, and re-synthesises the sound with the new information. This process can be lengthy, and turn around times of 20 minutes for the computer to synthesise half a minute of sound were common using the more complicated and ambitious IRCAM software in '84. Compared to the analog set up, there is no immediate manipulation or feedback possible, and no such empirical work method. The patch programs are therefore a great deal more mediated than analog techniques.

We can now see that the differences between the digital and analog media are profound. The gains with digital technology are power and generality, and so the potential - which we see pursued at IRCAM - for both a far broader and more flexible range of timbre in sound synthesis, and for more refined control of the sounds and of their structuring. But the early digital technology, far from delivering a great leap forward, involved rather the loss of certain key attractions of analog technology. First, whereas analog technology had spawned a generation of small, portable and commercially available electronic synthesisers at different price levels, computer music synthesis was largely based around mainframe computers, high technology that was unavailable except through access to powerful institutions - a major problem for many composers (Pennycook in Emmerson 1986). Until the mid 80's, no sophisticated small and portable digital music technologies existed. Second, and most obviously, is the loss of realtime sound production and the institution of lengthy delays with digital synthesis. This problem subsumes other important and interrelated losses: of an immediate, empirical work method, and of gestural control of the sound producing devices. Instead, early digital synthesis was characterised by extreme mediation, temporal and conceptual, by profound abstraction and hyper-complex and scientific conceptualisation. As we have seen, to use the

programs the user needed skills in both computing and acoustic science. From this stems a further limitation inherent in early computer music. Given the exhaustive acoustic information that patch programs require to be specified in advance, and the time delays before playback of a sound, it is very difficult for the user to isolate precisely which parameters are responsible for which characteristic of the resultant sound. Not only is it therefore difficult to judge which parameter to change in order to improve the sound; but the programs treat each acoustic parameter independently, and do not lend themselves to exploring the interplay and interrelation between them. So in addition to being abstract and laborious, users find the programs unpredictable: paradoxical, given the appearance of a totally rationalist and scientific method. By contrast, analog synthesis allows just such an empirical, gestural exploration of the interplay of two or more sound-affecting parameters in realtime.

This observation contests the view, put forward by proponents of the patch languages, that they offer the potential for a thoroughly rational and total control of sound - based on the reasoning that any sound that can be digitally analysed can also theoretically be digitally synthesised. The gap between this ideology of their potential and the character of their actual use can be further illustrated by the following IRCAM incident, which highlights the unpredictability and 'irrationality' of the programs. During the IRCAM stage, a young composer, learning to use the 'Cmusic' patch program for the first time, synthesised an interesting and complex sound - by far the most musical result produced by the students so far, as the teacher commended him. Upon checking back on how the sound had been made, the teacher was surprised to discover that the young man had unwittingly written erroneous amplitude values into his file, which would produce 'foldover' and distortion in the sound. So the most aurally interesting result produced by the program had come from its technically incorrect use. Just as significant was the follow up: soon after, the composer attempted to reproduce the same rich sound by re-synthesising using exactly the same (erroneous) values as before. But try as he might, he could not recapture the same interesting sound, and found instead that each attempt produced slightly different aural results. Thus, even with the same values the program was unpredictable: it did not reproduce identical output given identical inputs. The notion of digital synthesis involving the total, rational and predictable control of materials - a positivist scientific model of repeatable experiments giving identical results - seems in practice in this case to be questionable.

By the 1980's, computer music was not confined to these high technological developments. Commercial digital synthesisers began to appear that aimed to provide useful tools for professional musicians; and they had certain clear advantages over the esoteric patch language/mainframe combination. There were two key developments: the Fairlight dedicated music computer, and the commercial technologies based on Chowning's digital FM method such as the Yamaha DX range. The Fairlight, which appeared around 1980, provides a range of interesting pre-programmed sounds, mainly digitally sampled and simulated acoustic sounds, that are controlled by a keyboard. It has a large computer memory so that composers can record into the memory a series of different musical tracks or lines and then adapt them against each

other. It thus provides an extremely malleable recording facility. In addition, composers can input into the Fairlight memory any other acoustic sound, by recording it and analysing it with the machine's inbuilt analog-to-digital convertor; once digitalised the sound can then be adapted and played with at will. The Fairlight proved extremely popular among commercial composers and pop musicians, and indeed among 'serious' composers who could obtain access to one. It also became notorious for replacing musicians' labour in recording session work. But its price - in the region of £20,000 in the mid '80's - was prohibitive even for many institutions, so that access remained difficult.

At the other end of the market, 1981 saw the advent of the first very successful small, cheap synthesiser based on Chowning's digital FM: the Casio VL Tone, priced at only about £35. Chowning was himself astonished at the Japanese miniaturisation of his technique - something he thought quite impossible. This and similar cheap consumer products are aesthetically quite poor, with a limited range of flat pre-programmed sounds and rhythm sequences controlled by switches and a small keyboard. But by 1984, the first sophisticated middle range instruments began to appear led by the Yamaha DX range of which the DX7 was heralded by many as a major advance. These instruments provide realtime and portable digital synthesis at relatively affordable prices (around £1,500 for the DX7) with keyboard controls and a rich and varied set of pre-programmed timbres. Two breakthroughs occur with the DX7: the possibility of the user programming their own digital sounds or 'voices'; and the touch-sensitivity of the keyboard. The DX7 is the first electronic or digital keyboard to attempt to emulate the touch response of the piano. And it takes it further, since the touch control can be linked up to a variety of sound-modifying functions rather than just producing one kind of response - (it can induce a vibrato, a crescendo, etc). The combination of FM synthesis and innovative gestural control made the DX range an extraordinary development. But all of these digital instruments, from Fairlight to Casiotone, centre basically on simple digital synthesis of discreet timbres, whether pre-programmed or programmable; so that, as they stood in the mid '80's, they were ignoring some of the more unique possibilities of computer music synthesis and control that we see developed at IRCAM.

The final major development within commercial computer music occurred in 1983 when, led by the giant Japanese corporations such as Yamaha that dominate the consumer technologies markets, an industry standard or protocol was agreed and established, called 'MIDI' (Musical Instrument Digital Interface). MIDI is a microprocessor that acts as an interface between digital machines and allows different makes of equipment to exchange digital information in a common 'language'. It is used to link together into a network a series of commercial digital technologies that can be combined for sound synthesis and control, including synthesisers but also microcomputers, sequencers and so on. The advent of MIDI, enabling one to link up new instruments such as the DX7 with the new generation of increasingly powerful personal computers, and all of this at prices affordable by professional musicians, has led during the '80's to the rapid blossoming of a musical culture based on digital synthesis and experiment. By linking up different machines, the power of the network becomes in theory unlimited. At the same time, digital recording techniques expanded; so that by the later 1980's many professional

composers were able to set up sophisticated digital recording studios at home based around music and recording software systems developed by companies specialising in personal computers such as Attari, or Apple for their Macintosh pc. The 1980's have therefore seen major changes in the means of musical production for consumers and professionals at large due to these widely distributed commercial developments (Norman and Dickey 1984, Manning 1985).

Appendix 8 The background to IRCAM's psychoacoustic and music research concerns: timbre, form, perception, and their relation to the computer

This Appendix gives a brief account of the historical developments over this century, arising from the impasses of musical modernism (see Ch.9 for more on this), which underlie the rising interest in, and research on, timbre, musical form and perception, and how these have been elaborated by computer music. This gives insight into the historical roots of the concerns of the musicians group, IRCAM's music-intellectual vanguard (Ch.6).

The functional tonal music system upon which baroque, classical and romantic music was based centred on manipulations of pitch, while timbre - sound colour - was a relatively less important parameter of composition. With the dissolution of functional tonality in early modernism, composers showed a new awareness of timbre, whether in Debussy's exploration of tone colour, or Varese's extension of the range of sound materials, or in the Futurists' polemical call to treat noise as musical material. These concerns also came together with the gradual development, from early in the century, of electronic instruments as means of new musical sounds. Schoenberg, however, is usually credited with being the first to theorise timbre as a major musical parameter through his 1911 concept of *Klangfarbenmelodie*: a 'melody' defined by successive changes of timbre rather than pitch. This concept, which predated his development of serialism, suggested that timbre could become a structuring principle of composition. But in fact Schoenberg's serialism remained centred on pitch manipulation; while it was his pupil Webern who made timbre a central structuring device in his pointillist works. For example, his Op.10, no. 1 ends with the same note played successively by a flute, flute and trumpet, trumpet, and celesta, so that movement is conveyed only by changes of instrumental timbre (Griffiths 1986).

The main thrust of the new post War generation of the avant garde, led by Stockhausen, Boulez and others, was the extension of serialism to control all musical parameters: from pitch, to duration, loudness and, they hoped, timbre. This was the ideology of so-called generalised or 'total serialism'. Stockhausen linked it to the scientific acoustic analysis of sound and the new electronic media. He described control of timbre as the 'fourth revolution' in compositional rationality, after pitch, duration and loudness. He saw in electronics the possibility of realising a rigorous and exact serialism of timbre, hitherto impossible because of the lack of a systematic, scalar framework for its analysis. In his Cologne *Elektronische Musik* studio, Stockhausen set out to create a systematic repertoire of artificially-generated timbres suited to serial manipulation. His aim was to achieve the combination of perfect sound material (pure sine tones) with a perfect theory (total serialism). This desire for a unity of expression and conception, of material and form, here by serialisation of all musical parameters, was common among the young post War avant garde and, we will see, remains strong in a different way even today.

Stockhausen used the existing Fourier acoustical analysis of timbre as the basis of his electronic synthesis. Fourier analysis allows any sound

to be decomposed into its component frequencies or partials and analysed as a combination of pure sine tones. It appeared, therefore, that any complex timbre could be synthesised simply by reproducing its spectrum using a set of electronic oscillators to generate steady-state sinewaves corresponding to its component partials. However, Stockhausen's method produced very poor results and monotonous electronic-sounding timbres.

It was this failure of early electronic synthesis in the service of hyper-rationalist total serialism, and of the acoustic analysis informing it, that (as we saw in App.7) lay behind the work of Risset and others on increased insight into timbre. I mentioned there how crucial the new computer technology was for this work, in allowing a new form of feedback between timbral analysis and then digital synthesis, with the idea that, in theory, digital synthesis can produce any timbre given appropriate information. Hence the interdependent evolution of scientific research and technological development around timbre. This generation of researchers provided two fundamental new acoustical insights into the qualities of interesting timbre: the importance of the independent micro-evolution of each partial in time, and the existence of degrees of random 'noise' associated with particular timbres. But they realised that physical descriptions alone could not explain the perceptually or musically meaningful aspects of timbre; so psychoacoustical research - on sound and music perception - was deemed necessary in order to select out the most perceptually important physical and cognitive dimensions. For example, I mentioned in App.7 the discovery that the perceptually crucial parts of the micro-evolution of a sound to the listener are the very beginning and end, the 'attack' and 'decay', so that adequate synthesis has to model these with care. These insights help to achieve a more organic, rich range of synthesised timbres, and reveal the extraordinary complexity of timbre for both analysis and synthesis - a problem that we see in Chs.6 and 7 continues to pose problems at IRCAM.

But the impetus behind some perception studies derived from a harsher critique of the total serialist impasse that had become apparent by the '60's. Composers and critics hostile to serialism, and concerned with audience's bewildered reception of the music, turned to issues of perception to explain its unpopularity. The problem with serialism, they argued, was that it was hyper-complex and fragmented, too complex to have musical meaning, because it neglected to pay attention to the character of musical perception and the public's perceptual limits. This argument lay behind the rise of an area of psychoacoustic research devoted to criticising serialism and calling for a return to tonality. IRCAM's psychoacoustician HM described it thus:

"Much of this cognitive psychology of music gets results which are aimed to show that avant garde music is impossible to perceive as meaningful because it violates certain fundamental structures of musical perception: for example, that violent movements in timbre, atonality or whatever are not musically perceivable. Then they produce experimental work on fifths, octaves, the basic tonal triads, major-minor tonality to show that these are the absolute basis of musical form as meaningful. So, beware: this is an intellectual war about the fate and future of music, for or against the avant garde, the end of tonality...".

A non-IRCAM composer explained: "This psychoacoustics, work on

perception, was seen as 'better science'! - a scientific refutation of the mistakes, the crudities of serialist modernism. It was meant to show serialism's category errors about what would make musical sense. Where mathematical or crude acoustical manipulations of parameters had been used, these were shown to have little musical-perceptual meaning for the audience. So, psychoacoustics is a scientific way of refuting the earlier modernist errors!". It is striking, then, that this research did not direct its critique primarily at serialism as music or aesthetic, but preferred a scientific critique based on the notion of universals of human perception.

At the same time, Schaeffer's *musique concrete* also converged upon concerns with timbre and perception. We saw in Ch.2 (and App.5) that *musique concrete* enlarged the musical sound world by using any taped sounds as material for composition. These often complex natural sounds, without specifiable pitch or rhythm and so irreducible to traditional musical parameters, were conceived of as whole 'musical objects' whose 'behaviour' must somehow be understood. In other words, *musique concrete* pioneered the use of a far broader range of complex timbres as musical material than ever before, and so began to develop forms of timbral analysis - hence Schaeffer's early psychoacoustical work. This story raises an important observation about the concept of timbre: that it is, essentially, a residual category - ie that which is not pitch, nor duration/time/rhythm, nor loudness. Timbre is, in fact, that which is produced by the complex interdependence of all these sonic parameters. This is one reason why studies of perception have increasingly been seen as essential to understanding the complex interdependence of variables subsumed within the 'catch-all' concept of timbre. But it indicates, too, how the rhetoric of 'timbre' is extremely loose and open.

A final factor in these developments concerns another major problem in 20th century composition: the absence of any unified or coherent approach to musical form and structure since the breakdown of the romantic tradition with the advent of modernism. Musical form and structure concern mainly the macro structuring, or high level organisation, of musical sound horizontally, through time, but also vertically, as with tonal harmony. Classical musical form had just about survived into late romanticism; but with the break from tonality at the turn of the century came the question of new forms to match the new musical systems of atonality and then serialism. Boulez in 1951 chided Schoenberg for the 'contradiction' of retaining classical form despite his invention of serialism; and his attitude became the common view that musical modernism must seek new kinds of form suited to the new sound materials. However, an overview of the century shows that no sustained, innovative modernist approach to form has emerged. Different modernist 'schools' have produced their own approach, and mutual criticisms abound: for example, we saw also that *musique concrete* was criticised by Boulez and others for its empiricist lack of concern with conceptualising structure and form. A common tactic has been to entirely reject the teleological character of classical form and so disavow the notion of musical structure-as-development. Instead, composers in the '50's and 60's commonly sought non-developmental, cyclic or static forms. But this has also been seen as unsatisfactory; so that the problem of new musical forms remains central to debates around modernism and its limits, and high on the musical agenda.

Two key developments to do with form have occurred. The first returns to timbre and its close association with time. Webern, as we saw, used timbral change to convey movement, as a formal device; and throughout the century composers have considered whether timbral change can structure music in time. This question has recently been taken further by the unique possibilities of computer music. We saw in App.7 that in digital synthesis, unlike electronic synthesis, each musical 'object' or timbre is built up out of its components from scratch, so that the objects are no longer inviolate but, in theory, infinitely malleable. The technology therefore provides the possibility of taking two such simulated timbral objects and, through the analysis of their components, building a 'bridge' or 'transition' between them. To do this requires seeking the most appropriate aural route or bridge, and doing 'micro-surgery' on the components to 'join' the two objects. Meanwhile, at the micro level each partial is evolving rapidly in time, while at the macro level the transitions construct musical time, a 'timbral syntax'. So one result of the interplay of timbre and time in timbral transition is that the internal, micro-temporal processes within the timbre, and the formal macro-processes produced by a sequence of timbral transitions, can become related. This has been linked to ideas about deriving macro musical forms from micro processes, and so the notion of unifying these very different temporal levels: again, a concept of unifying micro and macro, sound material and form. We saw a naive example of this in the IRCAM *stageaire's* idea, described in Ch.5, of unifying the structures of the musical 'molecule, apple and tree' - an example suggesting that the notion of unifying micro and macro is now a powerfully autonomous rhetoric. In this project, then, timbral objects need no longer remain discreet, but can be transformed, 'melted' into one another, thereby providing yet a new way of creating structural movement, or musical 'syntax', by timbral change. IRCAM's Chant program makes this possible through its ability to generate timbral transitions, for example, between the simulated sound of a human voice and that of an oboe. We see in Chs.6 and 7, then, that central to IRCAM's vanguard are the unprecedented musical possibilities of 'timbral transition' or 'timbral syntax', based on timbre as a structuring, formal device in conjunction with the unique potential of digital synthesis in programs such as Chant.

The second development around musical form involves a different level of computer applications. The work of writers such as Meyer (1956) indicates the parallels that have developed in the past between information theory and music analysis. In computer science related disciplines, we can trace a development from information theory through cognitive science to artificial intelligence: a kind of applied cognitive modelling with the computer both as analytic tool and means of simulation. A.I. is based on the analysis of forms of knowledge to extract their essential content and logic or rules, which are then re-described as a structure of inference and written as an 'intelligent' computer program, such as an 'expert system', that represents a simulation of that knowledge system. Similarly, in music there has been a development from music analysis as a purely analytic field to one that, employing the computer and in conjunction with the rise of A.I. and cognitive music studies, aims both to provide computer analyses of musical structure and also computerised models of 'musical knowledge' or

'rules' as aids to composition. The computer has become seen as a tool both for analysing the deep structures or 'cognitive rules' characteristic of certain musics, but equally for generating abstract structures as guides for composition.

There are two important observations to be made. First, we can see in these developments a subtle but profound elision between analysis and composition: the two are close to becoming as one. Thus, at IRCAM in 1984, the main psychoacoustician HM constantly entertained the desire to compose since he saw his work as generating compositional ideas, and other composers' use of his research disappointed him. Interestingly, a friend reported of him in 1987: "HM has given up on the idea of becoming a composer; he accepts that he's a good psychoacoustician, but that doesn't mean he's a good composer or can become one" [AV]. Second, the computer's ability to produce elegant abstract models has meant that its generation of new conceptual schemes for music, in particular mathematical and cognitive structural models, has become quite autonomous from the analysis of extant musics. This lies, for example, behind the A.I. influenced approach of IRCAM's Formes program, with its generalised and abstract, hierarchical and recursive ordering of objects and events in time. This tendency, also expressed in the scientistic conceptual foraging and constant search for scientific analogies that we saw in Ch.5, has longer historical roots in musical modernism, as I show in Ch.9.

In summary, we can see a move over the century away from the primacy of pitch towards a rhetoric of timbre, as a way to conceive both of musical sound material, and of musical form - the organising principle of composition. We have also seen an autonomous preoccupation with new musical forms, compounded by the development of A.I. and its implications for computer aided composition. The scientific study of cognitive universals has been implicated at both levels: psychoacoustical study of micro perception of timbre, and cognitive study of musical structure. I have shown, then, a convergence from several directions on interrelated concerns with timbre and sound material, timbre and time, timbre and form, timbre and perception. All of these are considered to be enhanced by the computer, since in theory it enables 'any imaginable sound' or musical structure to be both analysed and produced. But we can also see that timbre becomes a rhetorical catch-all, subsuming many diverse preoccupations. These developments have their bases in major problems in 20th century musical modernism: the sense of sterility attached to serial and other techniques of composition based on the primacy of pitch; the sense of need for new musical forms to match the new sound materials; and the errors and weaknesses of mid century rationalism and scientism. Timbre is held, at IRCAM and more widely, to offer ways forward at all levels. Overall, it is striking that the response to the deep musical and philosophical impasses of modernist serialism, both early and mid century, has been to amend and improve the rationalism and scientism through increasingly sophisticated technological mediation. Far from rejecting the deeper epistemological character of modernism, this is being refined and complexified, for example in the elision of computerised music analysis with compositional genesis. We see in the thesis, then, that the discourse within which IRCAM is situated is a scientistic refinement of the classic concerns of modernism.

Appendix 9 Transcribed interview with young IRCAM junior tutor and composer KF

KF was employed intermittently at IRCAM from autumn 1983 on as a junior tutor / composers' assistant. During 1984 he worked as tutor to visiting American composer FG, who was considered a difficult composer to work with. He was given short contracts, on low pay. He was aged 25 in 1984.

The whole of KF's family are professionally involved in music. KF's father, from whom he is estranged, is a conductor with his own contemporary music ensemble in a major provincial city. KF's mother had been a professional viola player; but she is now employed in the Ministry of Culture at the *Direction de la Musique*, where she is in charge of music administration for one of the regions of France. KF's brother and sister are also musicians. His brother plays cello in a well-known French jazz group; his sister plays harp in various classical orchestra. KF's girlfriend is an actress.

KF was thoroughly trained in classical music from childhood onwards, and ended by training in electronic music and composition at the CNSM in Paris (*Conservatoire Nationale Supérieure de Musique*). From adolescence he had become involved through friends and networks in producing scores for film and television, short pieces made in the studio, for which he was paid. He had also become seriously involved in playing in rock bands, and in rock studio work. Talking earlier in the interview, KF described how, the previous year, around the time he had come first to work as a tutor at IRCAM, he had taken the decision to stop doing commercial work (what he calls 'private' work) so as to move into doing exclusively serious contemporary music, as at IRCAM.

Q: "Now we were talking about a couple of weekends ago when I bumped into you doing that stuff in Studio 5. It was really very.. up tempo, sort of high energy - you call it rap, yeah? I'd call it funk.. It was with a rhythm machine, wasn't it? That kind of aesthetic?..."

KF: "Yeah, mechanical things..."

Q: "But very well produced, the rock sound was very strong."

KF: "That's a very easy kind of thing to do: you just take the rhythm track and build it up.. with multitrack, no other musicians, I did it all... For the rhythm I use the 'Drumulator' (drum synthesiser), not mine but a friend's... We had some trouble the night before, it wasn't working very well. A friend of mine - a sound engineer - came specially for that, but he couldn't understand some of the studio, so we lost 4 or 5 hours!"

Q: "Because the studio's such a mess?"

KF: "Yes!" (We laugh).

Q: "Is he a variete (pop) sound engineer? You brought him in to find out what was wrong?"

KF: "Yes, and he couldn't find out - for hours."

- We discuss confidentially how he used the studio illicitly, in 'off-time', and did not pay. He arranged this by mentioning it quietly to a director, who distributes this studio's time unofficially.

- Then we turn to the studio equipment available: I ask about the

availability of studio effects, which are used in popular music studio work to enhance sounds and are central to aesthetic invention.

Q: "What are the facilities in Studio 5 now? It's 16 tracks.."

KF: "Yes, with DBX (noise reduction)."

Q: "And then several 2 track - and 4 track - machines... Have you got any reverb units?"

KF: "No, but you bring it with you. I mean there are a couple of units lying around here..."

Q: "There are no other effects, though, are there? They're very bare on effects here..."

KF: "Yes, there's not much."

Q: "It's a different aesthetic I think..."

KF: "Yes, but it's because they don't need that, effects. I mean the sounds are completely built with the 4X, you just transfer it to tape, you don't have to change it afterwards..."

Q: "Yes, the techniques aren't the same. But, I don't know if you'd agree, but someone like you knows about those techniques, so you can choose 'Do I have them or don't I'. And a very few people, only perhaps AV that I've talked to, have really used the rock studio and know what's possible there aesthetically. But a lot of people here seem to have a bias that 'That stuff is low so I don't want to use it anyway', even when musically it might be interesting."

KF: "Yes, of course, but it depends on the way people are thinking about their own music and music generally. In the case of AV, it's pretty obvious that the rock style is in his music, the *variete* way of making the sound. The quality of sound comes from that. But it's quite clear and quite clean and wonderfully made. I think he has wonderful taste. I think he does really good stuff. I think he's one of the only ones who has the intelligence of connecting different worlds, you know.. He's quite contemporary in that."

Q: "So when other people here say 'Oh we don't need multitracking, effects...', do you ever feel: 'Why don't they learn those techniques from rock? They could be useful...'? "

KF: "Of course! But they don't want to do it because they are not from the same world, you know. They are not popular. (We laugh sympathetically)."

Q: "Sure, so in effect these divisions are still very very strong somewhere like IRCAM..."

KF: "Yeah."

Q: "Do you experience that? Does it make you feel uncomfortable?"

KF: "Here, me? No!.. No, and besides, nobody knows what I'm doing! (ie also pop and rock. We laugh)."

Q: "So as long as you have a 'split personality'..."

KF: "What do you mean by 'split'?"

Q: "Well, that you're here to do one kind of thing, and that apart from you nobody here knows that you do these other kinds of things (ie the pop, rock and commercial musics)..."

KF: "Yes, some people know, HU knows, JYC knows..a bit..."

Q: "But for you, you're happy to have these two different sides, different kinds of music, techniques? Do you feel that in your music you try to bring them more together like AV?"

KF: "I don't think so. I don't come from the popular side, if you like, but I respect that very much; I mean the good stuff, the original stuff. What I can say is.. that popular music - well jazz, pop.. gave me some

good pleasures, you know? And er, specially in doing it, more than listening to it. I think it's a very important function to be able to improvise music sometimes, with people; and just to very freely make something.."

Q: "More social and immediate.."

KF: "Yes and you can say things which are maybe a bit more the same, than if you do very serious work, but which are understandable by common people, friends of yours who are not particularly informed about contemporary music - my friends are from many different areas. When I do my music, I just want to be honest, that's all! So if I like to do something, I do it!"

Q: "So you're happy to use different languages, in a way?.."

KF: "Yeah."

Q: "One thing that interest me is when you said to yourself a year ago 'OK I'll stop that (composing for theatre, dance, TV, film) and do more serious things', to make a better reputation in that.. How do you see that?"

KF: "Well it's not so much a question of reputation. It's a question of working precisely on construction... Well I spent so much time doing such different things - I used to be an actor too - that I thought, sometime I have to do only one thing."

Q: "You took the stage in 1982, why?"

KF: "To know the computer techniques that I didn't know before."

Q: "And what had you heard about IRCAM? Did it attract you?"

KF: "I thought it was fascinating to see a kind of centre where people coming from different areas could work together. I thought that. I was sure it was quite interesting to see that situation. I mean the scientific stuff and the musical stuff."

Q: "Oh, collaboration between music and science. So you were interested in that and the computer techniques?"

KF: "Yes, yes."

Q: "Did you desire to come and work here, or..?"

KF: "Yes, I desired to come and work here, yes.. (we both collapse with giggles, since this is so self-evident!)"

Q: (Giggling) "Everybody does! Was that partly because of the prestige?"

KF: "It was specially because of the possibilities.."

Q: "Possibilities?.."

KF: "The technical possibilities, yes, essentially. In one building to get such different studios, meeting so many different people, just for talking about music or something else, I mean. This is the place where you can meet people, and.. to get ideas."

Q: "Yes. So you did the stage, and what did you learn?"

KF: "Chant and essentially Music X."

Q: "Did it go well?"

KF: "Well it was running OK, but I was not so fascinated by the technical facilities. It was something really without great possibility of running it. It's a way of using technologies which is.. bureaucratic! Bureaucratic techniques! (He laughs). That's slow, and (involves writing) functions, parameters.. It's a way of thinking which is not open but closed. And slow."

Q: "How about Chant? It's supposed to be quicker?"

KF: "Yes but it's not so quick, you know.. And besides, Chant is a program which resists too many things. This is not a program I like to use. It's because of the general configuration, which is on one side very complex - 'cos you have many different parameters to connect to

each other - but the problem is to run all that stuff together in a musical movement. If you want to create a musical movement with that it takes a lot of time to do it."

Q: "Also a lot of time, like Music X, but in a different way?"

KF: "Yes."

Q: "Is it fair to say that you didn't feel that pleased with your first experience of computer music in the stage, or were there any good things?"

KF: "I discovered the 4A. I worked on it a bit."

Q: "Who taught you, how did you find that?"

KF: "I can't remember. It was more in real time. I thought it was more interesting anyway, the idea of having a very big realtime machine, even if you want to pilot it with a very 'designed' program. It allows you to think about the (sound) organisation, without having to describe each sound bit by bit.."

Q: "You can work with sounds, more immediately. It was a realtime experience? Did you come out with a few bits of tape?"

KF: "Yes, yes." Q

Q: "Was DLW impressed with those *esquisses* (studies)?"

KF: "With what? What I produced in the stage? Nobody knew that I did those things! We were not supposed to compose! (laughs)."

Q: "But you found time to do it? At night or something?"

KF: "Yeah (at night)."

Q: "So between that time and coming in 1983, did you come much?"

KF: "Not much."

Q: "So how were you asked to come and work in '83 with FG?"

KF: "RIG (Pedagogy director) phoned me, out of the blue."

Q: "Had you maintained relations with RIG or anyone here?"

KF: "RIG, no. But with JYC, who was here, and HU.."

W: "So, when you decided to stop doing so much commercial work in 1983, tell me about that."

KF: "I wanted to have the most time possible to be involved in what I can do and practice here.. at IRCAM."

Q: "So you wanted to have more time here. And you had some income, too."

KF: "Yeah, yes of course (laughs), of course!"

Q: "So in fact it was when you started here that you made that decision. Can you explain a bit more about why, why you see these two things (his prior commercial work and IRCAM work) as opposed? Is it because you feel that in order to make enough progress in this world of composing for yourself and having a reputation as a composer, you have to give so much time to that that you can't afford to give time to doing those other things?"

KF: "Most of my time before I did both things, essentially. Of course I was interested in doing it (both kinds of music). But the problem is doing several things at the same time creates several levels, and it's not always pretty obvious to connect all the things together. It's hard, yes. Not specially for me, if you like, I mean I can connect them. But other people can't really: the outside, here (ie IRCAM can't 'connect' commercial and serious musical work)."

Q: "Don't you feel that if you produce a piece of ballet or theatre music that you like, why shouldn't you bring it to play here?"

KF: "Yes, I was meaning.. (more commercial music). But it depends.. everything is so complex. Of course it's possible. But to work with the outside, with the private (ie commercial) music world, the relation with the people is completely different, and the way to talk about the music

work is different, and the way to understand the work is different too. The people are different, simply. I mean, it's not just my way of seeing them, but really they are different. Because they don't know exactly what is contemporary music, what is jazz music, what is.. rock music, I mean this is a total confusion in their mind. So when I work with them, I don't try to explain what it is, what the music is, I just listen to them, try to understand what they want; and with regard to that I try to find what might be musical interest in that, and with what I can play.. like a game!"

Q: "So you try to produce what you think they want..?"

KF: "What I think they want, but in a way that amuses me! You know.."

Q: "Do you mean there's no point in talking to them about 'do you want rock, do you want this'; they'll just be more naive, saying they want something with rhythm..?"

KF: "Yes, generally speaking they are pretty naive."

Q: "And you mean that here, of course, the classification between different kinds of music is very clear and very strong..?"

KF: "Yes, I think it is.. I don't know what you think, but I think it is!" (We both laugh).

Q: "Sure. But what I'm interested in is the fact that you decide that you will work here at IRCAM given the constraints that say 'you must do this kind of music, you can't do that, you can't do that, you must do this..'"

KF: (*Faux naif*) "Who says that?"

Q: "Well I think it's in the house, in contemporary music.."

KF: "Ah yes (as though it's just dawning). But in fact I prefer the situation like that!.."

- Tape ends.

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